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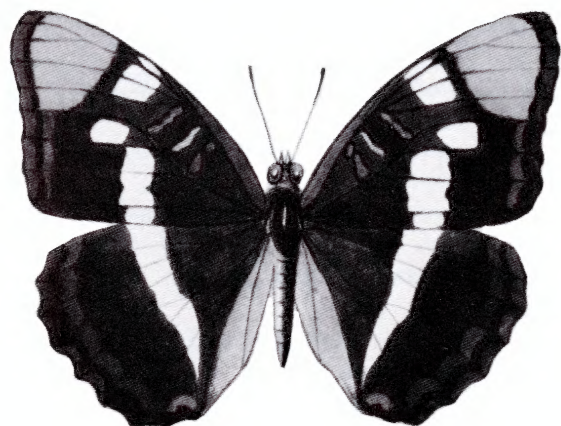


THE BUTTERFLIES *of Southern California*

By Thomas C. Emmel
and John F. Emmel

NATURAL HISTORY MUSEUM
OF LOS ANGELES COUNTY

THE BUTTERFLIES OF SOUTHERN CALIFORNIA



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VIRGINIA D. MILLER, EDITOR
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Los Angeles County*

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*Dedicated to two outstanding
lepidopterists of southern California*

JOHN ADAMS COMSTOCK

and

LLOYD M. MARTIN

Foreword

FROM THE EARLY part of this century, interest in collecting butterflies in southern California has been stimulated by the Natural History Museum of Los Angeles County and the associated Lorquin Entomological Society. The members of this group have contributed greatly to the information in this book through their indefatigable collecting and generous sharing of data over the years. Some of the very early lepidopterists of this southern California group—Fordyce Grinnell, Carl Coolidge, Victor L. Clemence, Virgil Owens, and John A. Comstock—were founders of the Society and were among the first collectors to place accurate data labels on their specimens. Many of their original specimens are still in the entomological collection of the Museum today.

In the late 1920s and early 1930s, the second wave of enthusiastic lepidopterists became very active, due to the publication in 1927 of John A. Comstock's *Butterflies of California*. Then, Jean D. Gunder published in 1930 an article on the "Butterflies of Los Angeles County" in the *Bulletin* of the Southern California Academy of Sciences, increasing activities and interest in the field. The Lorquin Entomological Society members were by this time mainly butterfly collectors who sponsored an annual "Butterfly Show" each spring at the Museum. This show encouraged more young people to study Lepidoptera. Jean D. Gunder, George E. Malcolm, F. W. Friday, Charles Ingham, John A. Comstock, Hal Newcomb, John S. Garth, Chris Henne, Jeanette Riddel, Jacob Windlinger, and myself were very active at this time.

When Commander Charles M. Dammers, with his interest in life history work, came into contact with the Natural History Museum of Los Angeles County, John Comstock taught him to draw and paint illustrations of the eggs, larvae, pupae, and sometimes the adult stages of our southern California species. He became very accurate in his work. At about this same time, John L. Sperry and his wife, Grace, built a little museum in back of their home in Riverside to house their large collection of butterflies and moths. Charles N. Rudkin, William Burdick, Don Meadows, and many others were quite

active in collecting, and contributed greatly to the knowledge of the butterflies of southern California. Comstock and Dammers utilized many of these collectors' "finds" in their paintings and joint publications on butterfly and moth life histories.

With illustrations of the life histories of many of our butterflies by C. M. Dammers (most published for the first time) and John A. Comstock, this present book will be especially valuable to the student in understanding the biology and adaptations of the species and subspecies found in southern California. Since the annotated check list of the butterflies of Los Angeles County by Jean D. Gunder (1930), no similar publication has been printed. This book is, therefore, long overdue, and it should create much interest among laymen and biologists. With the accumulation of accurate information from the long list of collectors of the past and present, this book should help many young people in developing further their interest in entomology and point the way for further studies of the taxonomy and biology of the butterflies of southern California.

LLOYD M. MARTIN
CURATOR EMERITUS AND
RESEARCH ASSOCIATE (ENTOMOLOGY),
NATURAL HISTORY MUSEUM OF
LOS ANGELES COUNTY,
PAST PRESIDENT, LORQUIN
ENTOMOLOGICAL SOCIETY

Preface

IN THE FIVE DECADES since the publication of John Adams Comstock's *Butterflies of California*, no publication has appeared to summarize new information on the distribution and biology of the southern California butterfly fauna. Yet lepidopterists reside here in the highest density in the United States, and they have been extraordinarily active in uncovering new data on previously unknown populations, and even new species, especially in the realms of foodplant and life history material. Additionally, a large and ever increasing number of naturalists live in southern California and have an avid interest in the living fauna of the area, including the showy butterflies. Thus the need for this present book was obvious, and in 1968 the first steps were taken by one of us (TCE) toward developing a cooperative project on the publication of such a work with the urging of Charles L. Hogue, Lloyd M. Martin, and Fred S. Truxal of the Natural History Museum of Los Angeles County.

Our initial discussions outlined the scope and direction of the project. A systematic polling was begun of all members of The Lepidopterists' Society residing in the southern half of California and Arizona for information they could provide. Copies of the preliminary mimeographed check list were returned with detailed annotations by more than one hundred collectors, and from these data a new offset printed version of the check list was circulated during mid-1969. Extensive correspondence over the next three years continued to provide very detailed information on localities, distributional extensions, flight periods in different areas, taxonomic revisions and descriptions in press or contemplated, foodplant records, life histories, relative abundance, and behavioral observations. The inclusion of John F. Emmel, special field trips, and searching of the Comstock and Dammers life history files at the Natural History Museum of Los Angeles County by us filled in some of the gaps that still existed. In the meantime, Charles Hogue and Fred Truxal successfully found funding for this publication in the fall of 1972. Those who helped in this project are cited in the Acknowledgments, but we wish to acknowledge especially the great number of hours put in by Hogue

on the preparation of the text illustrations.

We would like to mention several specific points for the benefit of those who will be using this book:

1. In the color-plates figure caption, the data on brief locality labels have been amplified by adding the county names or other current qualifying information to enable future workers to locate the geographic sources of these specimens. For specimens reared by past workers, often only the emergence dates are given in the plate legends because the date of field collection of the parental females or larvae was absent from the labels. In some cases, no collector's name was listed on the label and is absent from the figure legend.

2. The principal mountain ranges of southern California, commonly referred to in the text, are shown in Figure 1. Additional reference to any good oil company highway map or county maps of the Automobile Club of Southern California will enable the reader to locate the various ranges more precisely. One particular note should be made. In Comstock's day, the term "Sierra Madre" referred to the mountains in the immediate vicinity of the Ridge Route (the approximate area now occupied by Interstate Highway 5 over Tejon Pass), but today it refers to a range of mountains in Santa Barbara County as shown in Figure 1. The old Ridge Route was a winding mountain highway between Los Angeles and Bakersfield, which passed through the resort of Sandberg's near the crest of the road southeast of Gorman. Many of Comstock's specimens were taken in this area and were labeled "Ridge Route, Sierra Madre."

3. The Life Zone concept is used to describe distributions of butterflies largely restricted to a characteristic zone. Aside from mentioning typical plant associations in each account of a butterfly species, it seemed impractical within the scope of this book to break these zones down into the plant community categories used in *A California Flora* by Munz and Keck.

4. We have included authors' names for all foodplants listed. Note that botanists use a slightly different system of author citations than entomologists. For instance, "Smith *in* Rees" or "Benth. *ex* Jones" briefly describes the taxonomic treatment accorded these entities by previous workers and hence are a significant part of the plant's identifying name to botanists. We also use plant family names after all cited foodplants so that trends in host preference among butterfly species and higher categories such as genus and family may be easily discerned.

5. The arrangement of species reflects our preferences and ideas regarding phylogenetic relationships. Collectors may prefer to arrange their

collections after the sequence used by dos Passos (1964).

6. Finally, it should be stated that this book incorporates the latest data available to us through March, 1973. We hope to issue a revised edition following this first printing, and thus we solicit contributions, corrections, and additional information from all readers of this book, as for example, new distributional and life history data that have not already been cited in the text; identifications of new food-

plants should be carefully confirmed. Letters may be sent to us at the Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007.

THOMAS C. EMMEL

JOHN F. EMMEL

March 1973

Acknowledgments

AWORK OF THIS magnitude and detail would not have been possible without the great cooperation of a very large number of lepidopterists. Charles L. Hogue, Lloyd M. Martin, and Fred S. Truxal of the Natural History Museum of Los Angeles County have extended every possible encouragement and courtesy over the years of development of this book and for some fifteen years previous to this project. We owe an immeasurable debt of gratitude to each of them.

Among the more than one hundred living lepidopterists who have contributed to these pages are a few who have given an unusual quantity of valuable data and unstinting cooperation at every step. These are Ray E. Stanford, Chris Henne, Robert L. Langston, Oakley Shields, and Fred Thorne. Their long and detailed letters and other sources of information have contributed greatly to the unique value of many of the species accounts. Noel McFarland has contributed to us, for nearly two decades, his invaluable life history and botanical knowledge.

The many other collectors who have generously supplied us with their records through the initial editions of the check list of the butterflies of southern California are as follows: Paul H. Arnaud, Jr., Nelson Baker, David L. Bauer, Dorothy Beals, Peter Bellinger, Richard Breedlove, James Brock, F. Martin Brown, John T. Cooper, George J. Crouchet, Thomas Davies, Rod Davis, Robert Denno, Stanley Dvorak, Richard Funk, Rosser Garrison, John S. Garth, Lawrence E. Gilbert, Glenn A. Gorelick, Bruce M. Griffin, D. H. Gudehus, William Hammer, Charles Harbison, William Hedges, John H. Hessel, Henry Holmes, William Hovanitz, Keith Hughes, Richard Hulett, Noel E. LaDue, John Lane, Ronald Leuschner, John T. McBurney, Paddy B. McHenry, C. Don MacNeill, Sterling S. Mattoon, James R. Mori, Paul A. Opler, Donald Patterson, Edwin M. Perkins, Mark Robert Plunkett, Jerry A. Powell, Richard Priestaf, Kilian Roever, Allen Rubbert, James A. Scott, Charles Sekerman, Oscar E. Sette (now deceased), Jon H. Shepard, Steve Sims, John M. Snider, Dennis Sorg, John Spencer, Allen R. Stephen, and J. W. Tilden.

We are indebted to Paul R. Ehrlich of Stanford University and to Peter H. Raven, now of the Missouri Botanical Garden, for valuable discussion on some of the interesting biological problems uncovered during our field work through California. Dennis E. Breedlove (California Academy of Sciences) and Robert F. Thorne (Rancho Santa Ana Botanic Garden) have contributed much useful botanical information.

Aside from many of the previously mentioned people who have read portions of the book's text, Julian P. Donahue and Hogue kindly read and edited the entire manuscript and offered many suggestions. Armando Solis accomplished the difficult tasks of preparing the black and white photographs of the Comstock and Dammers' paintings, as well as the plates. The cover illustration is the work of William Howe.

The publications, unpublished notes, and specimens of those deceased lepidopterists have contributed much to this book. Foremost are John Adams Comstock and Charles M. Dammers, whose paintings and drawings of life histories form an invaluable legacy for lepidopterists, naturalists, and scientists who wish to know more about the biology of these fascinating insects—the butterflies.

THE BUTTERFLIES OF SOUTHERN CALIFORNIA

By THOMAS C. EMMEL and JOHN F. EMMEL¹

INTRODUCTION

Southern California is part of the third largest state in the union and with its tremendous topographic relief ranging from 282 feet below sea level in Death Valley to 11,502 feet above sea level at the top of Mt. San Geronio, it supports a remarkably large and interesting flora and fauna. One of the most noticeable groups in this fauna are the butterflies, whose great numbers and colorful wings lend a bright attraction to the flower-spangled hills in the spring, summer, and fall.

We are fortunate in having at least 167 butterfly species in southern California, here defined as that part of California south of a line drawn from San Luis Obispo on the coast to Panamint Springs in the Death Valley region of eastern California (Fig. 1). If we had included the southern Sierra Nevada area just north of the Greenhorn Mountains, the number of butterfly species would increase to 200 or more. Comstock (1927a) recorded 236 butterfly species for the entire state! It is quite probable that future collecting in our northern coastal mountains and especially in the eastern desert areas will turn up additional species for our fauna.

The first part of this book includes introductory sections on distributional zones for butterflies, general comments on collecting in southern California, and an historical survey of activities of early lepidopterists in our region. Then we take up each of the nine families of butterflies in detail. A brief description of the characteristics of the particular family precedes the accounts of the species in that group. The format within each species account treats the geographic distribution, habitat preferences, flight season and number of broods, general biology and behavior, foodplant records, and life history information known to date. Citations of scientific papers where further details may be learned are included if particularly important or extensive in information content. An appendix of rarely recorded species or doubtful records is included to treat butterflies that are only rare visitors to our area or that have been erroneously credited to southern California. Finally, a check list of the butterflies of southern California is provided for the convenience of interested specialists and those who wish to keep a permanent record of species seen or collected.

DISTRIBUTIONAL AREAS FOR BUTTERFLIES

Each species of butterfly tends to have a particular habitat or set of habitats in which it is normally found. The choice of a vegetational association is always dependent in part upon the presence of a suitable foodplant, but even with a host available, a peculiar temperature regime, slope exposure, or other environmental factors may prevent the establishment of the butterfly itself. Naturalists recognize general types of regions or life zones, each supporting a distinctive flora and fauna, and most species of butterflies tend to be restricted to vegetational associations within one or perhaps two of these zones. As one ascends through these zones in southern California, one sees almost totally different groupings of butterfly species in each belt of life. Since we will be referring to life zones in the subsequent species accounts while discussing butterfly distribution, we briefly characterize these regions, starting on the desert floor and working up to the highest peaks.

The *Lower Sonoran Zone* is represented by the lower portions of the Colorado and Mojave deserts (Figs. 2 and 3). The annual rainfall is less than ten inches and the growing season is limited by strongly seasonal precipitation to brief periods in the spring and the late summer. The plants are adapted to high insolation, highly variable seasonal and diurnal temperatures, and rocky or sandy soils. Creosote bush, cactus, ironwood, and a great many annual wildflower species are characteristic plants.

The *Upper Sonoran Zone* is typically chaparral in our area, a densely growing brush thicket or "elfin forest" that clothes the foothills up to 4500 ft elevation (Figs. 4 and 5). *Quercus* (Oaks), *Cercocarpus* (Mountain Mahogany), *Ceanothus* (Wild Lilac), *Yucca*, and other shrubby plants are adapted in many ways to conserve moisture. The annual rainfall varies from 14 to 25 inches and the climatic regime is characterized by hot, dry summers and cool but not cold winters. The growing season extends from eight to twelve months. The rich diversity of woody shrubs supports a great many hairstreak species in this zone. Riparian associa-

Thomas C. Emmel, Department of Zoology, University of Florida, Gainesville, Florida 32601

John F. Emmel, Research Associate in Entomology, Natural History Museum of Los Angeles County, Los Angeles, California 90007

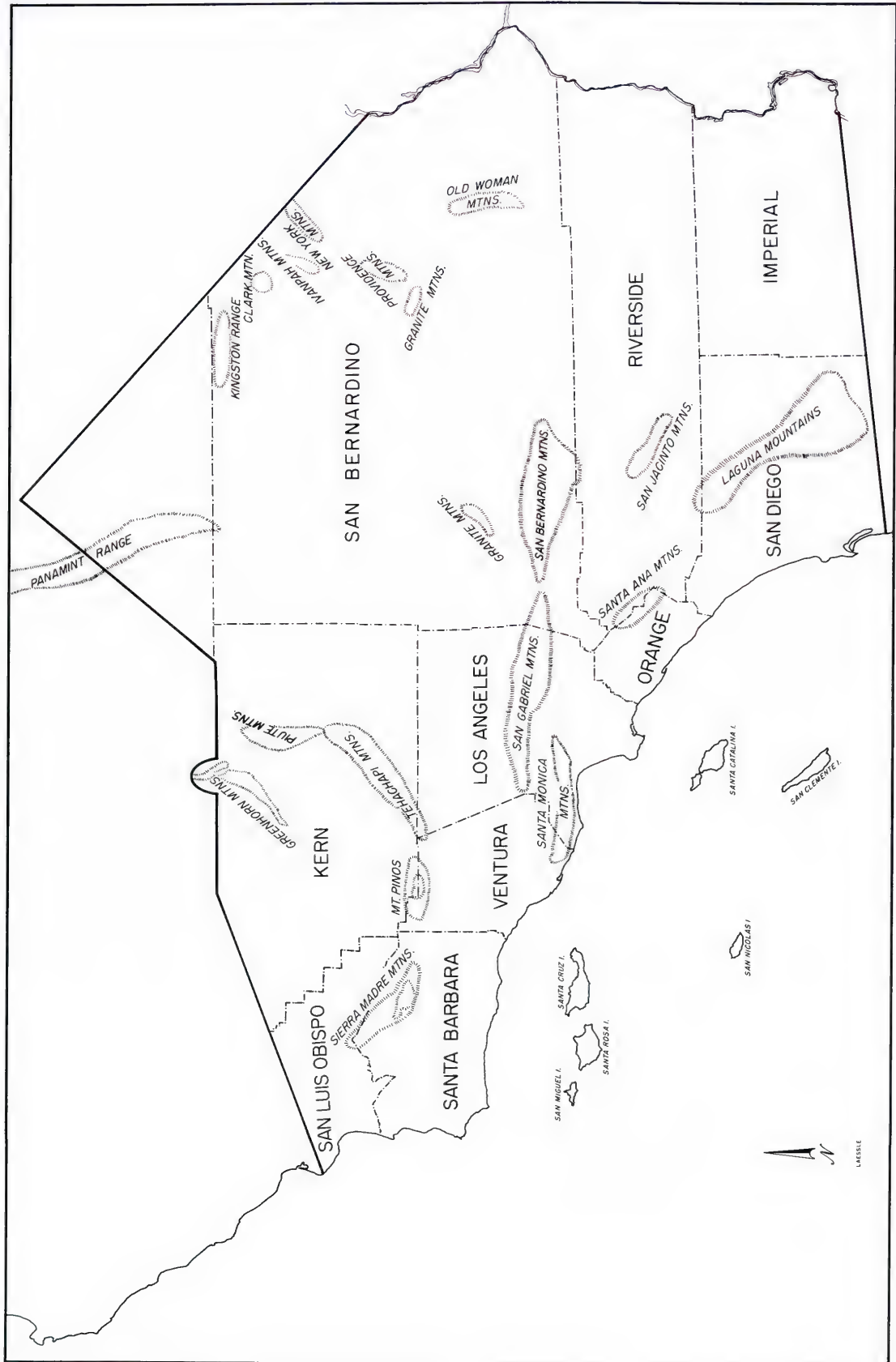


FIGURE 1. Map of southern California, indicating county boundaries and principal mountain ranges mentioned in text.



FIGURE 2. The Lower Sonoran Life Zone in the Mojave Desert: the Providence Mountains of eastern San Bernardino County (left) and the Calico Mountains of western San Bernardino County (right).

tions of cottonwoods and willows along streams support still additional butterflies.

The *Transition Zone* represents a broad intermediate area of coniferous forest mixed with oak trees and shrubby species (Fig. 6), before one ascends into the boreal zones of the higher mountain peaks. It extends from about 4500 to 8000 ft elevation in our area. The most characteristic tree is *Pinus ponderosa* (Yellow or Ponderosa Pine), and *Libocedrus decurrens* (Incense Cedar) is often common. The annual precipitation is 25 to 50 or more inches, partly in the form of snow, and the cold winters restrict the growing season to four to seven months, with high temperatures in the summer.

The *Canadian Zone* in southern California occurs from about 8000 to 9500 ft and is characterized by Jeffrey Pine and firs growing in dense forests. The average annual precipitation is 35 to 65 inches, with heavy winter snow, and the growing season is only three to five months.



FIGURE 3. A palm oasis in the Lower Sonoran Life Zone of the Colorado Desert (Cottonwood Springs in Joshua Tree National Monument), a favorite area for the desert orange-tip, *Anthocharis cethura*.

The *Hudsonian Zone* begins above 9500 ft and tends to be quite discontinuous due to frequent steep bare rocky slopes. It continues to timberline at approximately 11,000 ft (reached on Mt. San Geronio). Lodgepole Pine (*Pinus murrayana*), several currant species (*Ribes*), and other subalpine plants characterize this zone. The average annual precipitation is about 30 to 50 inches, mostly as heavy snow in winter. The growing season is only seven to nine weeks.

The *Arctic-Alpine Zone* is restricted to the area above timberline on Mt. San Geronio in southern California. This depauperate representation of a few acres of alpine vegetation is too small and isolated to support any of the alpine butterfly species found in the Sierra Nevada to the north. The low perennial herbs grow as cushiony plants or low turf. The average precipitation is about 25 to 35 inches annually, predominantly as snow. The growing season lasts only four to seven weeks, with low summer temperatures even during the daytime.

COLLECTING IN SOUTHERN CALIFORNIA

While most butterfly species are seasonal and their flight periods are restricted to a particular time of the year, the climate of a subtropical region permits adult activity of at least some species out of the total fauna at any point in the annual cycle. Thus it is possible to collect all year in the coastal lowlands of southern California, especially in the vicinity of San Diego.

Beginning in early February or even late January, one can start collecting spring-flying species in the lower cismontane areas. In late February, March, and early April, the deserts are at their spring peak and one may find several swallowtail species, orangetips, marbles, checkerspots, and blues in fair abundance. From April through June, the chap-

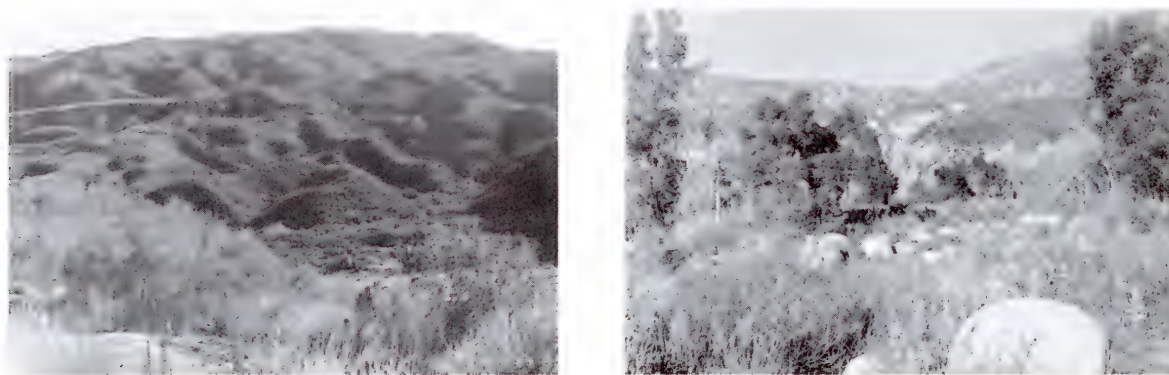


FIGURE 4. The Upper Sonoran Life Zone near Hemet, California: chaparral-covered hillsides (left) and a riparian wash habitat with oaks and sycamore (right).

arral habitats are at their peak for hairstreaks, pierids, checkerspot, swallowtails, and the first skippers. By mid-May, the Transition Zone species begin full flight. During June, July, and August, the higher elevations in the mountains become the most lucrative areas to collect, although many choice species wait until the summer months to appear in the lowlands, too. In the fall months of September and October, when collectors in other

parts of the country are putting away their nets and are starting to relax and spread the year's catch, the fortunate southern California collectors are out in the field again to harvest the rich diversity of fall-flying species, particularly choice strays and migrants from neighboring Arizona and northern Mexico. Collecting at this time is especially good if the deserts have been well watered by heavy summer rains.



FIGURE 5. Chaparral habitats in the San Jacinto Mountains of Riverside County, rich areas for hairstreak species in the late spring.



FIGURE 6. The Transition Life Zone near Idyllwild in the San Jacinto Mountains (left) and at Barton Flats in the San Bernardino Mountains (right).

Even in the dead of winter, when most eastern collectors have nothing to look upon but fields of snow, California lepidopterists may go into the deserts and collect such desirable species as *Megathymus coloradensis martini* as larvae in "tents" in *Yucca* plants, or collect hundreds of pupae of the spectacular Great Purple Hairstreak, *Atlides halesus*, under select sycamore or walnut trees laden with mistletoe.

The question of where to go on a collecting trip depends entirely on the collector's aims. Reading through the text accounts of our species will give him an excellent idea of appropriate areas to go to for a rich diversity of species, for a particular species, for early stages of a certain butterfly, or for exploration of relatively uncollected regions. In the course of writing this book, it became obvious that much remains to be learned about butterfly distribution in even the best collected areas of southern California. The geographical and altitudinal ranges of most of the skippers are much more poorly known than those of the other butterflies. Many of the smaller desert mountain ranges have not been investigated by collectors. Even the San Gabriel Mountains hold many remote canyons and ridges that have never been visited by lepidopterists. There is an unverified record from the early 1950s of a population of a Sierran species, *Chlosyne hoffmanni*, being found in a dry meadow in that Los Angeles County range.

For lepidopterists who wish to try new areas in the expectation of turning up new butterflies, we specifically suggest the following locations for more extensive exploration:

1. The Colorado River Valley and the mountains bordering the river are virtually uncollected in both the Mojave and Colorado deserts. It is expected that many Mexican and Arizonan species will eventually be taken in this area in the fall months

as strays, and the native butterfly fauna of this region is not known at all.

2. The Death Valley region is another no-man's-land for lepidopterists. Although a number of collectors have taken very brief trips here, no one has intensively studied the many diverse habitats found in this ecologically unique area. Several butterfly subspecies have already been found to be endemic here.

3. The Piute Mountains region of the eastern part of Kern County, just south of the Sierra Nevada, has been explored very little. Several lepidopterists have taken an interest in this area in recent years and have produced some excellent records. This region is a buffer zone between the south end of the Sierra Nevada and the Coast Range, which should result in unusual faunal elements.

4. The high mountains of Santa Barbara and of western Ventura counties are virtually uncollected.

5. Numerous small mountain ranges in the Mojave and Colorado deserts are waiting to be sampled by enterprising lepidopterists. Four-wheel drive vehicles and bipedal locomotion, along with considerable determination, are the main requirements needed to reach the unknown lepidopteran treasures of these ranges.

Although the life histories of many southern California butterflies are known, the specific foodplants utilized in various areas are in general not well determined. An extensive review of the literature concerning butterfly foodplants and procedures for determining and reporting new hosts are described by Shields, Emmel, and Breedlove (1969).

In summary, there is much left to be accomplished in increasing our knowledge of southern California butterflies, which makes the excitement and expectation of each field trip that much greater. Amateur as well as professional lepidopterists have a rich contribution to make right here in southern California.

EARLY LEPIDOPTERISTS IN SOUTHERN CALIFORNIA

Southern California has long been a mecca for those who study butterflies. The rich diversity of its habitats, the striking contrasts in faunal composition as one ascends from dry desert to alpine peak, and the rapid growth in human population with a proportional increase in those with an interest toward natural history, have all contributed to the growth of our knowledge on the butterflies and the wealth of distributional and life history data we have today.

The first famed collector in California, Pierre Joseph Michel Lorquin, was a naturalist who was seduced by the lure of gold nuggets and the loss of his family fortune to embark for the fabled West in 1849 from his native France. Landing in San Francisco, he left at once for the gold fields and worked as a digger on placer claims. But the gold he found was insufficient to even procure the necessities of life. He returned to San Francisco and worked at various jobs which permitted him to live and make a little money. His family came by sea to join him and with more free time, his sleeping interest in entomology was reawakened. Exploring at first the San Francisco area, he then made trips (1850-1856) along the Sacramento and Feather rivers and into the Sierra Nevada range. His later travels (1861-1862) took him as far south as Los Angeles. Throughout this period he faithfully sent letters from the field and series of specimens back to his friend, Boisduval, in Paris, who published three major papers (1852, 1855, and 1859) in the *Annals of the Entomological Society of France*, describing the many new species Lorquin had discovered. Lorquin also sent many specimens to the Felders who named (among a number of new species) the Desert Orangetip, *Anthocharis cethura*, and the beautiful Sonora Blue, *Philotes sonorensis*, from his southern California material. The Lorquin's Admiral, *Limenitis lorquini* Boisduval, was one of the more spectacular finds, and honors the name of this early lepidopterist. The name of the Lorquin Entomological Society of southern California also commemorates this pioneer of the Gold Rush days, who found more gold in new butterflies than he did in the ground.

At the turn of the century, the nucleus of an extraordinarily active and proficient group of lepidopterists began gathering in the Los Angeles area, and these founding members of the group were to remain major workers in the field over the next few decades. William Greenwood Wright, a store keeper and part-time bootlegger in San Bernardino, began making extensive collecting forays into the little visited desert areas and discovered a number of new butterflies. His book, *The Butterflies of the*

West Coast, was published in 1906 and, while sparse on text descriptions of butterflies and other information (he was fanatically secretive about "sharing" his finds with others), it was the first account written specifically on our fauna and included excellent color plates with illustrations of many type specimens. His large personal collection was sent to the California Academy of Sciences at San Francisco in 1905, as the Academy curators had expressed great concern over its storage in Wright's barn where his still created a fire danger. The next year, the collection went up in smoke in the 1906 earthquake and its resultant fires in San Francisco. Two other early collectors, at the turn of the century, were Fordyce Grinnell and Carl Coolidge; the latter carried out a number of excellent life history studies which are still unsurpassed today, while Fordyce Grinnell was the originator of the old Lorquin Natural History Club in 1913. Jean D. Gunder settled in the small town of Pasadena about the same time and began intensive studies of the checkerspot butterflies (genus *Euphydryas*). His intensive field work and purchase of specimens from collectors sent out by him led to a long series of papers on western butterflies, including an important, fully illustrated publication in a 1929 issue of the *Pan-Pacific Entomologist* on "The Genus *Euphydryas* Scud. of Boreal America (Lepidoptera, Nymphalidae)," which still stands as a landmark of careful taxonomic study in this difficult genus. If any failing be assigned to Gunder by other lepidopterists, it was his propensity for naming aberrations and "transitional forms" in great numbers. In 1930, Gunder published the first major faunal checklist specifically on our area. It was entitled "The Butterflies of Los Angeles County, California," and appeared in the *Bulletin of the Southern California Academy of Sciences*. Here he summarized the 178 resident and occasional species and forms known to him, and gave details on "where to go, when to go and what to collect." The Gunder collection is now in the American Museum of Natural History.

George E. Malcolm built a very large private collection of California butterflies during the 1920s and other young collectors such as Chris Henne (now living at Pearblossom), John S. Garth (now a professor at the Allan Hancock Foundation, University of Southern California), Charles Ingham, Hal Newcomb, and F.W. Friday were starting to make major contributions to our knowledge of the southern Californian butterfly fauna. Chris Henne has assembled probably the most beautiful collection of personally reared material in existence and has published a number of taxonomic and life history papers on his researches. John Garth has published major faunal works on the butterflies of

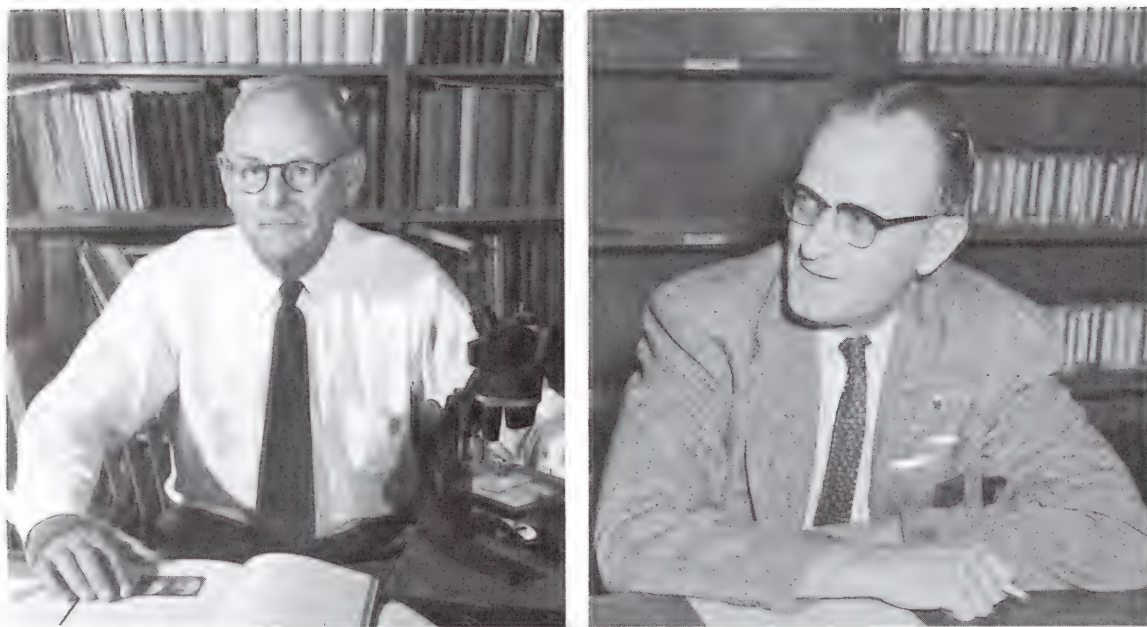


FIGURE 7. John Adams Comstock (left) and Lloyd M. Martin (right), the two "deans" of southern California lepidopterists.

Grand Canyon and Yosemite National Parks as well as shorter taxonomic papers, and his intimate knowledge of Glacier Park and southern California butterflies will soon result in additional books on these areas. Hal Newcomb, now deceased, had the unfortunate habit of selling specimens with incorrect labels for high prices, as "new" for a particular area.

Fred Thorne of El Cajon in San Diego County began about this time to carry out intensive field work and life history studies throughout that little studied southern California area and the lower Colorado Desert region.

By far the best known lepidopterists from the 1920s to the present, though, have been John Adams Comstock and Lloyd M. Martin (Fig. 7), men whose long and intimate association with the Natural History Museum of Los Angeles County have built the entomological reputation of that institution into honored worldwide recognition. John Adams Comstock was born in Evanston, Illinois on January 30, 1883, a descendant of William Comstock who had emigrated from England and settled in Massachusetts in 1635. His interest in entomology and especially Lepidoptera began at an early age, and at 15 he was elected Secretary of the Chicago Entomological Society. As a teenager he made several long collecting trips to Florida and Colorado. Late in 1906 he and his family moved to Santa Rosa, California, and after attending medical college in Los Angeles he was licensed (1915) to practice medicine and surgery in California. In

1917 he helped found the Lorquin Entomological Society (then a section of the Lorquin Natural History Club) and was elected its first president. Two years later, the Royal Entomological Society of London elected Dr. Comstock as a Fellow. He became associated with the Southwest Museum of Los Angeles at that time, and ten years later (early 1928) he was appointed Acting Director of the Natural History Museum of Los Angeles County. He served in various curatorial and administrative capacities there for the next two decades, and after his retirement in 1948 he was given the position of Curator Emeritus of Entomology. He continued his extraordinarily active entomological researches at his home laboratory in Del Mar, California, right up to his death on December 26, 1970. A visit to his home was an enriching experience for all who had the fortune to meet him and see him at work there.

During his 87 years Dr. Comstock produced some 236 scientific papers, most dealing with Lepidoptera of the American Southwest and particularly California. His early field work in our area and extensive cooperative endeavors with other outstanding lepidopterists culminated on April 14, 1927, when the major book *Butterflies of California* was published. Illustrated with 63 exceptionally clear and precise color plates, the book immediately became the classic and authoritative reference on the butterfly fauna of the state. His attention turned to working out in greater and greater num-

bers the life histories of California species. In collaboration with Charles M. Dammers, a retired British naval officer, scores of detailed and beautifully illustrated life history descriptions were published in the *Bulletin of the Southern California Academy of Sciences*. Comstock made many trips to Arizona, and illustrated the early stages of many Lepidoptera that had not previously been described. Several trips to Mexico and American Samoa also resulted in major scientific publications on the life histories of tropical butterflies. The invaluable permanent records of Comstock's life history studies, in the form of watercolor paintings and pen-and-ink drawings, are now deposited at the Natural History Museum of Los Angeles County along with those of Commander Dammers. The halftone reproductions in this book were produced from these illustrations.

Eight years after Comstock came to the Natural History Museum in Exposition Park, Lloyd M. Martin, a young local lepidopterist, came to him seeking employment as a student assistant. Thus a career began which spanned more than 33 years of service at the Museum and did more than any other to personally encourage young collectors of Lepidoptera on the West Coast.

Lloyd Milo Martin was born on a homestead near Bayard, Nebraska, on May 24, 1912. After the death of his father in a farm accident four years later, he was raised by his grandparents in Steele City, Nebraska. Trips back to the farm became his first collecting forays as he helped a cousin collect butterflies for her collection. In December 1921, Lloyd moved to Long Beach, California, with his grandparents, and his collecting activities increased. In his own words, "Many species of butterflies, so different from those of the farm in Nebraska, were caught in California; this was the beginning of a real interest in insects. It was my ambition to get a college degree and, some day, to work in a museum. The depression of the early 1930s put an end to plans for college. After graduation from high school in 1929, I worked for Hal Newcomb in South Pasadena, doing butterfly art work. This work went on for about a year. From May 1930 to October 1935, I worked at Butterfly Park, near Roscoe (now Sun Valley), for Albert Carter. [This commercial effort by Carter to build a showplace of butterflies failed.] During the summers of 1931 and 1932 I was in the field, collecting butterflies for Jean D. Gunder of Pasadena. I made two trips to the Catalina Mts of southern Arizona in the spring of 1931; later in the same year I collected at Pyramid Lake, Nev., in the Cascade Mts of northern California, including Mt Shasta. The summer of 1932 was spent in the field in southern California."

On February 19, 1936, Lloyd Martin started working for John Comstock at the Natural History Museum of Los Angeles County as a Student Assistant in entomology. Like Comstock, he donated his personal collection to the Museum. In 1941 he was promoted to Assistant Preparator, then to Curatorial Assistant in 1943, and on July 1, 1944 to Assistant Curator of Entomology. In 1952 he was promoted again to Associate Curator, in charge of all Lepidoptera at the Museum (some 250,000 specimens at that time). He held this position until his retirement on July 31, 1969, at which time he was given the title of Curator Emeritus. He continues as a Research Associate of the Museum, operating from his home in Prescott, Arizona, where he is avidly continuing his researches on the moths of that fascinating state.

During his three decades at the Museum, Lloyd Martin carried out the usual curatorial duties of collecting, classifying, and preparing insects for the Museum collection and for exhibition, as well as identifying insects for scientific government agencies and the general public. His greatest source of pleasure, though, was encouraging young collectors through the Lorquin Entomological Society meetings and field trips, and through answering thousands upon thousands of questions from them especially every Saturday up on the "third floor" of the Museum at Exposition Park. Under Comstock and then Martin, the holdings of the Entomology Section of the Museum greatly increased in size and diversity. Comstock and Martin were both active collectors and outgoing individuals who attracted the volunteer cooperation of many amateur collectors, old and young, in the Los Angeles area which helped accelerate the growth of the collection.

Lloyd Martin wrote major papers on the butterfly fauna of the Huntington Lake region in California and an annotated check list of North American Lepidoptera in the Natural History Museum of Los Angeles County, described several new butterflies including *Papilio indra fordi* Comstock & Martin and *Euchloe hyantis andrewsi* Martin, and wrote a widely-noted article, "Spectrum on Wings," for *Arizona Highways* magazine (April 1951 issue) describing the beauty of Lepidoptera found in the Southwest. He intensified his personal field work in Arizona together with Fred S. Truxal, and the Museum rapidly accumulated an outstanding collection of butterflies, moths and other groups from the little known insect fauna of that state. Lloyd said in a recent biographical sketch, "My real interest was trying to find out how insects could survive in the semi-arid regions and deserts of the Southwest. I was fascinated by their adaptations to the environment, the changes of color patterns to blend

in with the desert, the vast numbers of species of insects that are nocturnal in habit, and the comparatively few diurnals, due to the inclement conditions in which they live." His photographs and vivid descriptions of these studies at many national and regional meetings of the international Lepidopterists' Society, the Southern California Academy of Sciences, and the Lorquin Entomological Society, brought to thousands of biologists the richness of the natural history of the American Southwest.

Despite all the preceding accomplishments, Lloyd Martin has always maintained a helpful attitude toward all beginning students of Lepidoptera. His finest legacy, and the one of which he can be most rightfully proud, is the generation of biologists who have been profoundly influenced to go into serious amateur or professional work with Lepidoptera because of his dedicated example and constant encouragement.

There have been a great many additional local lepidopterists who have contributed greatly to our knowledge of the biology of southern California Lepidoptera, some of national and international reputation. We have arbitrarily ended our relating of this historical story with the men who became active in the area before the end of the 1930s, as the later chapters are still being written by the current workers.

SPECIES ACCOUNTS

Family PAPILIONIDAE

Most members of this family have one or more taillike projections on the hindwing—hence the common name of swallowtails. The Papilionidae includes many of the largest and most colorful butterflies in the world, and the nine species in southern California are no exception. The adults usually have a strong, purposeful flight which can carry them rapidly out of reach of the collector. They often feed on flowers; while all swallowtails have six fully developed walking legs to cling to a blossom, because of their size and weight on such a precarious nodding platform, they usually maintain their balance by a rapid vibrating movement of the wings. Our species are distributed among a wide range of habitats, starting from low open desert (*Papilio rudkini*) to the tops of the highest mountains (*P. indra*), and the yellow Western Tiger Swallowtail (*P. rutulus*) is a common sight along our shaded suburban streets and city parks. The larvae are usually smooth skinned and possess a fleshy forked organ (the osmeterium) which can be protruded from the front of the body and emit a strong repelling scent. Broad-leaved trees and shrubs are the foodplants of half our species, while the larvae of our members of the *Papilio machaon* complex feed on members of the carrot

family (Umbelliferae) (*P. zelicaon* and *P. indra*), shrubby Rutaceae (*P. rudkini*), or Compositae (*P. bairdii*).

THE ANISE SWALLOWTAIL

Papilio zelicaon zelicaon Lucas

Plate I, figure 4

This swallowtail is common throughout the state and becomes abundant during most of the year in the lowlands of southern California. Its distinctive black and yellow pattern cannot be confused with that of any except *Papilio rudkini* and *Papilio bairdii bairdii* form "brucei." Fortunately for the collector, the geographic ranges of *P. zelicaon* and these other species do not overlap except in a narrow band along the western desert's edge, from the east end of the San Bernardino Mountains south to eastern San Diego County. *Papilio zelicaon* is distributed throughout southern California except in the desert areas. It has been taken on Santa Cruz Island in the Channel Islands of Santa Barbara County. It can be taken in all months of the year in coastal San Diego County. Further north and in inland areas, it begins emerging in February to March at low elevations and April to June as the elevation increases. At the higher elevations, it is single or double brooded; *P. zelicaon* is multiple brooded in the lowlands. Males are ardent hilltoppers, being commonly encountered at the tops of peaks and rock outcroppings (see Shields, 1967, for a complete discussion of hilltopping behavior in this and other species). In the San Joaquin Valley, *P. zelicaon* is becoming an important economic pest on *Citrus*.

Foodplants: Various species of the carrot family, Umbelliferae, including especially Wild Anise (*Foeniculum vulgare* Mill.) throughout the lowland areas (a plant introduced from Europe); also, *Tauschia arguta* (T. & G.), *Lomatium dasycarpum* (T. & G.) Coult. & Rose, *L. utriculatum* (Nutt.) Coult. & Rose, *L. dissectum* var. *multifidum* (Nutt.) Math. & Const., *Oenanthe sarmentosa* Prest., *Heracleum maximum* Bartram (all Umbelliferae), and *Citrus* species (Rutaceae).



FIGURE 8. First, fourth and mature larvae, and pupa: *Papilio zelicaon*. (Paintings by C. M. Dammers.)

Early stages (text fig. 8): The spherical egg is a delicate lemon yellow when first laid, and changes to a mottled color and then blackish brown before hatching. The first three immature larval stages are black with short spines, orange spots, and a white "saddle" pattern on the middorsal area. The fourth and fifth (mature) instar larvae are vivid green, striped with black on each segment and with orange spots in each black band. The pupa may be green or brown in color.

BAIRD'S SWALLOWTAIL

Papilio bairdii bairdii Edwards

Plate 1, figures 7-9

One of our state's rarer butterflies, *Papilio bairdii* so far has been found only in the San Bernardino Mountains of San Bernardino County. It flies from May to September and is at least double brooded, the number of broods depending mainly on the amount of rainfall each year. Adults and larvae have been taken in fair numbers at Seven Oaks at 6000 ft elevation, Barton Flats, Camp Radford, and the Santa Ana River Canyon. Males "hilltop" as high as 11,502 ft (top of Mt. San Geronio) and the species breeds at elevations as high as 9100 ft (Onyx Peak). The yellow form, "brucei", turns up occasionally in the Barton Flats area, representing about 1-4 percent of the adult population. From crossing studies it seems that the "brucei" phenotype is controlled by a gene recessive in expression to the normal black dominant gene. Form "hollandi" is an even rarer capture; on the hindwings part of the "brucei" yellow region is filled in with black scales.

Foodplant: *Artemisia dracuncululus* L. (Compositae). In captivity, larvae may be reared on wild anise (*Foeniculum vulgare* Mill.).

Early stages (text fig. 9): The spherical egg is pale green. The mature larva is usually green with a black band across each segment; each band contains a series of orange spots. Some larvae become almost totally black. The pupa is brown or green.

RUDKIN'S SWALLOWTAIL

Papilio rudkini Comstock

Plate 1, figures 1-3, 6

A swallowtail of the open desert, *Papilio rudkini* is distributed from the east end of the San Bernardino Mountains north through Victorville to the Death Valley region and east to Nevada, and extends south through the deserts to Baja California and east to Arizona. The flight period ranges from February to October. The spring brood emerges in February, March, and April from overwintering pupae; sporadic emergences continue until fall from the pupated offspring of the spring brood. Abundance seems to be closely correlated with amount of rain-

fall and leaf condition of the food plant. Summer rains sometimes trigger large emergences so that there may be more adults flying in September than in the previous March in the same spot. The black form "clarki" seems to be more abundant in the eastern edge of the Mojave Desert (e.g., the Providence Mountains area) than in San Diego County, but it is always rare. Form "comstocki", intermediate between typical *rudkini* and "clarki" in band width and often with extensive submarginal blue areas on the hindwings, is scarcer than typical *rudkini*. The adult polymorphism is genetically independent of the equally diverse larval and pupal color polymorphisms. That is, black larvae do not give rise to adults of form "clarki," nor do brown or green pupae yield adults of a single color form. Because of the agility and speed of the adults in the desert canyons and out on the open desert floor, it is usually easier to rear specimens by collecting mature larvae in the field.

Foodplant: Turpentine-Broom, *Thamnosma montana* Torr. & Frem. (Rutaceae). Larvae have never been found on any native Umbelliferae except in the Sheephole Mountains in 1966; under conditions of exceptional larval competition, larvae switched to *Cymopterus panamintensis* var. *acutifolius* (C. & R.) Munz (see Emmel and Emmel, 1969). In the laboratory, *P. rudkini* larvae may be readily reared to maturity on *Foeniculum vulgare* Mill. Pupae have been known to delay emergence for 4-6 years in the laboratory and are probably capable of doing the same under conditions of low annual rainfall in the deserts.

Early stages (text fig. 12): The egg is spherical and light green when freshly laid. The mature larvae are quite variable, ranging from almost totally green or white forms with thin black segmental bands to almost totally black forms with the green or white areas reduced to one or two thin streaks per segment (see figures). Pupae may be green or brown.

THE INDRA SWALLOWTAIL

Papilio indra Reakirt

Four of the seven known subspecies of this swallowtail occur in our area:

(a) THE SHORT-TAILED SWALLOWTAIL

Papilio indra indra Reakirt

Not figured

In California this rare western swallowtail typically occurs in the higher elevations of the central to northern Sierra Nevada range and the coastal mountains north of San Francisco Bay. A male of *P. indra indra* was taken by Jim Brock on Piute Peak in the Piute Mountains, south of Lake Isabella in Kern County. Here at the southern extremity of the

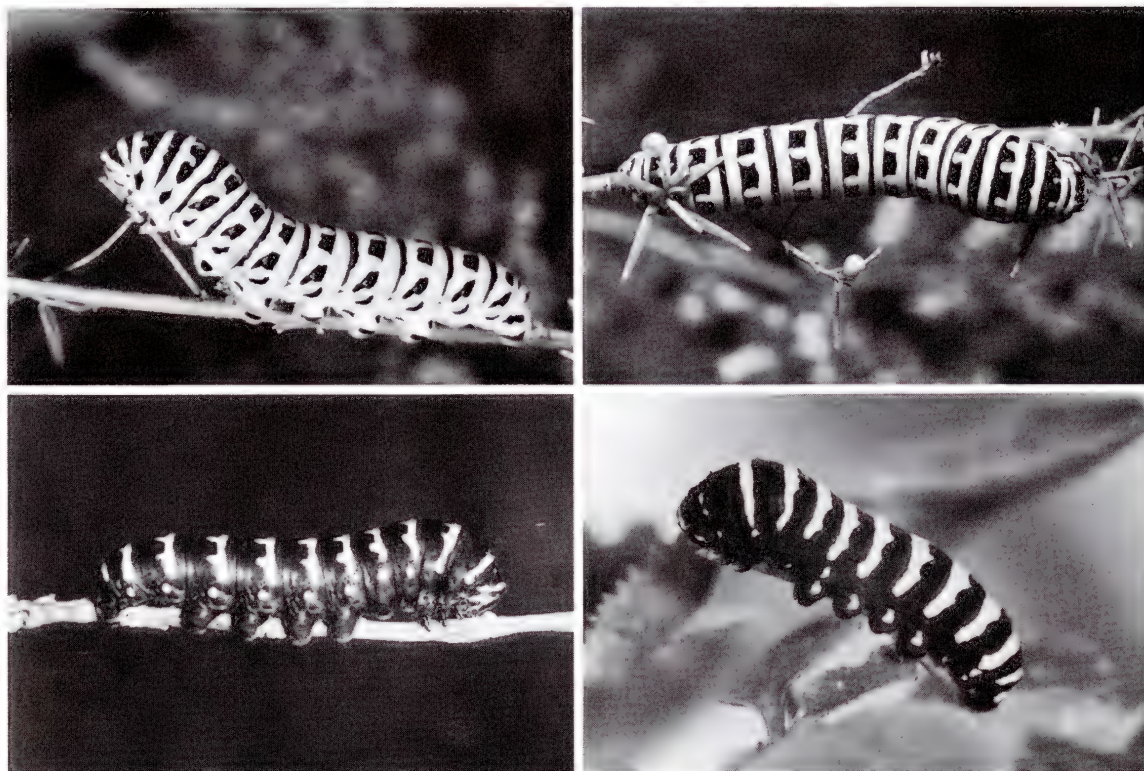


FIGURE 9. Mature larvae: *Papilio bairdii*—upper; *P. indra indra*—lower left; *P. indra fordii*—lower right. (Photographs by T. C. Emmel.)

Sierran influence is undoubtedly the southernmost record for the typical race. The subspecies is characterized by its relatively small size, tiny tails, and medium width yellow band.

Foodplants: Probably *Tauschia parishii* (C. & R.) Macbr. (Umbelliferae) in the Piute region; elsewhere in California the subspecies feeds on various Umbelliferae, including *Lomatium marginatum* (Benth.) Coult. & Rose, *Pteryxia petraea* (Jones) Coult. & Rose, and *P. terebinthina* (Hook.) Coult. & Rose.

Early stages (text fig. 9): The globular egg is light cream in color. The mature larva is black with a narrow yellowish to pinkish band arching over the anterior half of each segment. The spots located in these light bands are deep yellow-gold. The head capsule pattern includes long gold stripes on a black ground color. The pupa is brown.

(b) EDWARDS' SWALLOWTAIL

Papilio indra pergamus Hy. Edwards

Plate 1, figure 11

In the central mountain ranges of Los Angeles, San Bernardino, Riverside and San Diego counties flies a long-tailed race of *Papilio indra*, named *pergamus* by Henry Edwards a century ago in 1874. In

the Los Angeles area, one may find *P. i. pergamus* at the Camp Rincon area in San Gabriel Canyon, around Idyllwild in the San Jacinto Mountains, or along the south side of the San Bernardino Mountains. Far more specimens have been taken to the south in San Diego County, primarily on Tecate Peak, Monument Peak, Garnet Peak, Mt. Laguna, and other high areas in the Laguna Mountains. Males frequently "hilltop", while females are generally found around flowers or the larval foodplants. May is the peak flight period, with adults taken as early as the last week of March and as late as the last week of June.

Foodplants: *Tauschia arguta* (T. & G.) Macbr., *T. parishii* (C. & R.) Macbr., *Lomatium lucidum* (Nutt.) Jeps. (all Umbelliferae).

Early stages (text fig. 11): The globular egg is light cream. The mature larva has the black ground color present in the other *indra* subspecies reduced to patches and replaced by greatly expanded white bands. The spots bordering these "bands" are yellow. The larval head capsule is largely deep yellow in color, with the black areas reduced to narrow streaks. The pupa is brown and somewhat larger than those of the other subspecies.

(c) FORD'S SWALLOWTAIL

Papilio indra fordii Comstock & Martin

Plate I, figure 10

California has had the greatest concentration of resident amateur and professional lepidopterists of any state in the union. Thus in the early 1950s it was very surprising that a new race of *Papilio indra* could be discovered within a hundred miles of Los Angeles! The story of this discovery is well worth recounting, and it may stimulate readers to look more closely in their own "backyards" for new discoveries in the Southern Californian butterfly fauna.

Out in the Mojave Desert exist various "ecological islands," such as small mountain ranges surrounded by arid desert, which have been isolated for hundreds or thousands of years. A botanist, F. R. Fosberg, wandered into such a range, the Sheephole Mountains, in 1932 and collected specimens of an unusual umbelliferous plant, *Cymopterus panamintensis* var. *acutifolius*. On these plants he found larvae of a *Papilio* species and Fosberg took them to the Natural History Museum of Los Angeles County where John A. Comstock identified them as related to *P. indra pergamus*; they were not reared to the adult stage. Then O. E. Sette collected two strange *Papilio* adults in 1949 in the Granite Mountains near Lucerne Valley, but these specimens remained unknown in his private collection at Stanford. Two years later, another amateur lepidopterist took additional specimens in the Granite Mountains which led to the description of the new subspecies *fordii* in 1955 by Comstock and Martin, the two "deans" of southern California lepidopterists. Their account (Comstock & Martin, 1955) of the discovery of *fordii* describes the inhospitable terrain in which the butterfly is found:

On April 1, 1951, Mr. Robert J. Ford, of Southgate, California wandered into the "Granite Mountains," a few miles north and east of Apple Valley, San Bernardino County. He was not of course the first human to venture there. Hunters and prospectors by the scores, and before them, doubtless, Indians by the centuries, had ventured into this inhospitable maelstrom of granite. All of them were discoverers of a sort, but Mr. Ford was doubtless the first lepidopterous discoverer.

The region is one that appears to be the last place in the world to look for and expect to find butterflies. It is exceedingly arid, and completely covered with a jumble and maze of giant boulders, for all the world like a deserted battleground, a gigantomachy of ancient Titan warriors, who fought with rugged crags and pinnacles, and left them, broken and strewn about, in aeons past.

Superficially, it would seem that not even a plant could find a foothold here, — much less a fragile butterfly.

Actually, although the rainfall is exceedingly scant, such as does occur falls on barren rock, and is gathered in a series of drainage basins, each flowing into a pocket of more or less hidden soil, where it is shielded from evaporation, and conserved for the few plants established there.

One of these plants is *Cymopterus panamintensis*

C. & R., an umbelliferous species that is limited to the eastern Mojave Desert and the Death Valley region.

On this, Mr. Ford found *Papilio* larvae, and about it were hovering swallowtails that he recognized as something new.

In keeping with the tradition that seems to hold with our local lepidopterists, Robert Ford shared his "find" with others, and soon there was a group at work obtaining specimens and information.

Today, we know the distribution of *Papilio indra fordii* extends from the Calico Mountains south to the Granite Mountains northeast of Apple Valley, and southeast to the Sheephole, Coxcomb, and Eagle mountains, and other rocky mountain ranges of this western half of the Mojave Desert. At the Providence Mountains it is abruptly replaced by another subspecies, *P. i. martini*. The adults fly from early March to April. The larvae are more commonly encountered and mature stages may be taken in late April on the foodplants in the mountain canyons. It has not been found in the Death Valley region despite the appearance of its foodplant there.

Foodplant: *Cymopterus panamintensis* C. & R. var. *acutifolius* (C. & R.) Munz (Umbelliferae) and occasionally (under conditions of defoliation of the normal foodplant) *Thamnosma montana* Torr. & Frem. (Rutaceae) (see Emmel & Emmel, 1969).

Early stages (text fig. 9): The globular egg is light cream in color. The mature larva is black with a narrow to rather broad white band; as in the other subspecies, this light band extends posteriorly around each of four large dots, which are lemon-yellow in *fordii*. The head capsule is black with an inverted "V" of orange. The pupa is light tan and mottled with various darker shades.



FIGURE 10. Pupae and mature larva: *Papilio indra martini*. (Photographs by T. C. Emmel.)

(d) MARTIN'S SWALLOWTAIL

Papilio indra martini Emmel & Emmel

Plate 1, figure 5

In 1963 a second new extraordinary subspecies of *Papilio indra* was discovered by the authors in the remote Providence Mountains of the eastern Mojave Desert, San Bernardino County. California lepidopterists had collected here rather regularly for nearly half a century for various endemic or otherwise unusual butterflies, such as a brown *Euphydryas*, *Papilio rudkini*, and Arizona species that penetrated into our state at this location. Over several years the authors collected immatures and reared the adults, finally obtaining the type series and describing the new butterfly in 1966. It was named after Lloyd M. Martin who has done so much to promote the study of southern California Lepidoptera.

A number of lepidopterists have collected *martini* in the Providence Mountains since its description. The first and principal adult brood flies from late March to late April. A small second brood probably emerges from non-diapausing pupae in June and July. Like other *indra*, the adults "hilltop".

The butterfly in the type locality occurs only about 40 miles from the nearest *P. i. fordi* population, yet the wing markings are dramatically differ-

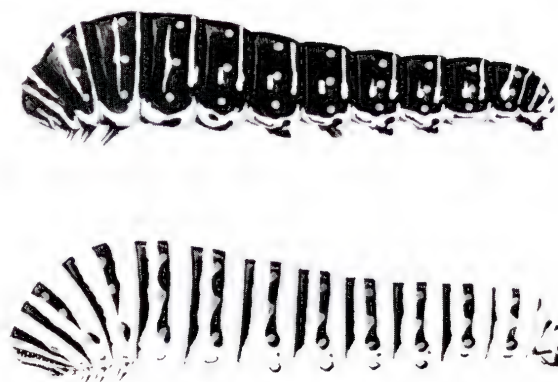


FIGURE 12. Dark and light forms of mature larvae: *Papilio rudkini*. (Paintings by C. M. Dammers.)

ent. Instead of the wide yellow hindwing bands of *fordi*, the *martini* race typically has a triangularly narrowing yellow patch at the leading half of the hindwing and this tapers to a thin, irregular line until it reaches the posterior margin of this wing or even disappears.

Presently, *P. i. martini* is still only known from the Providence Mountains (peaks, Bonanza King Mine Canyon, Gilroy Canyon, Mitchell Caverns State Park area). However, it should be found in the New York Mountains, Clark Mountain, and the Kingston Range where its foodplant is distributed.

Foodplant: *Lomatium parryi* (Wats.) Macbr. (Umbelliferae).

Early stages (text fig. 10): The globular egg is light cream. The mature larva is black with a narrow to rather broad pink or salmon colored transverse band arching over the anterior half of each segment. The usual row of dots in this band are deep ochre yellow. A white patch is found on each proleg and at the base of other segments. The head capsule is black with an inverted "V" of deep orange. The pupa is light tan to greenish or grayish tan.

THE GIANT SWALLOWTAIL

Papilio cresphontes Cramer

Plate 1, figure 12

This *Citrus*-feeding swallowtail is a relatively recent arrival to our state, despite more than a hundred years of orange and lemon orchard culture. With confirmed records going back to 1963, *Papilio cresphontes* now ranks as a definite resident in the citrus areas of the Imperial Valley in Imperial County, and it has jumped north to the citrus groves of the San Joaquin Valley in Kern and Tulare counties. Lane reported its presence 4.5 mi N Blythe, Riverside County in late August 1968. It was resident at Bard near the Colorado River since at least 1963 and

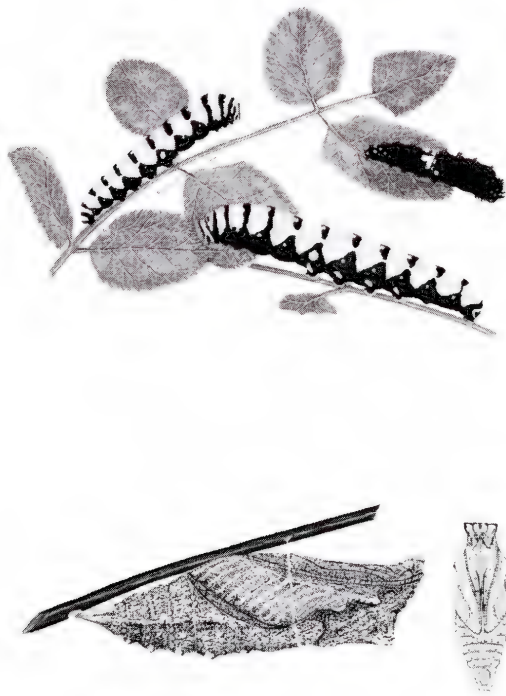


FIGURE 11. Early instar larvae-upper; mature larva-lower right; pupa: *Papilio indra pergamus*. (Paintings by C. M. Dammers.)



FIGURE 13. Mature larvae and pupae: *Papilio cresphontes*—left (from Edwards, 1884); *Battus p. philenor*—right. (Paintings by C. M. Dammers.)

is currently a breeding resident in the Bard and Winterhaven areas with adults flying from March to October. It is quite common at times in the residential areas of Brawley (since at least 1966).

Foodplants: various *Citrus* trees (Rutaceae) in California. To the east and south into the tropics other native trees are also utilized as larval foodplants.

Early stages (text fig. 13): The spherical egg is light green. The mature larva is dark brown with creamy white markings on the thorax, the end of the abdomen, and a broad white "saddle" across the middorsal portion of the body. The pupa is brown.

THE WESTERN TIGER SWALLOWTAIL

Papilio rutulus rutulus Lucas

Plate 1, figure 16

A familiar summer sight in city parks and sycamore-shaded streets, the yellow and black-striped *Papilio rutulus* is one of our commonest swallow-

tails and may be found throughout southern California wherever one of its many foodplants grows. It normally flies from March to September, but early adults have been taken the first week of February. The species goes through one to three broods, depending upon elevation and hence length of the growing season. The last brood overwinters in the chrysalis stage.

Foodplants: The principal foodplant below 4000 ft elevation in southern California is Sycamore, *Platanus racemosa* Nutt. (Platanaceae), but from the family Salicaceae various willows (*Salix* species) and members of the genus *Populus* (Aspen, Cottonwood, Poplar) are also utilized (Brower, 1958) by the larvae of this swallowtail.

Early stages (text fig. 14): The sub-conoidal egg (flattened at the base) is smooth and deep green. The mature larva is also deep green; back of the first abdominal segment is a yellow line, edged posteriorly with black. On the metathorax are two yellow spots, bordered with black and pupiled with a blue spot. The pupa is dark brown and looks much like a chip of wood.



FIGURE 14. Mature larvae and pupae: *Papilio rutulus*—left; *P. eurymedon*—right. (Paintings by C. M. Dammers.)

THE PALE SWALLOWTAIL

Papilio eurymedon Lucas

Plate I, figure 13

From late March into August, one finds this white and black-striped *Papilio* flying through chaparral-covered foothill canyons and in the mountains of the western portion of southern California. The males will "hilltop" even in the foothill areas. Robert Langston has collected *P. eurymedon* from late April to mid June on Santa Cruz Island in the Santa Barbara Channel and found it "about as common as on the mainland."

The whitish *Papilio eurymedon* is frequently sympatric with the Western Tiger Swallowtail, *Papilio rutulus*, and both species may be quite abundant in the same moist canyon. Brower (1959) did field experiments in Utah to show that yellow *Papilio multicaudatus* males were not attracted to white *P. eurymedon* females, but no investigation has been done on the extent of interspecific courtship in nature between *P. rutulus* and *P. eurymedon*. This would be an interesting research problem for a lepidopterist in southern California to pursue.

Foodplants: Buckthorn, *Rhamnus crocea* Nutt. in T. & G. and *R. californica* Esch.; California Wild Lilac, *Ceanothus* species (all in family Rhamnaceae). Also, the Holly-leaved Cherry, *Prunus ilicifolia* (Nutt.) Walp. (Rosaceae) (see Emmel & Emmel, 1963) and occasionally domesticated *Prunus* (oviposition recorded on peach at Costa Mesa in Orange County by James R. Mori).

Early stages (text fig. 14): The nearly spherical egg is yellowish green. The mature larva is soft green, with yellow and black markings as in *P. rutulus* except for the detailed pattern of the thoracic "eye spots" (compare accompanying figures). The pupa is dark brown and is heavily streaked with blackish brown on the dorsal half.

THE TWO-TAILED SWALLOWTAIL

Papilio multicaudatus Kirby

Plate I, figure 14

Our largest swallowtail, this yellow multi-tailed *Papilio* has thinner and shorter black stripes than its common relative, the Western Tiger Swallowtail. The known distribution of *Papilio multicaudatus* in southern California includes the Greenhorn Mountains (Cedar Creek); the Old Ridge Route southeast of Gorman in the Tehachapi Mountains; the Mt. Pinos region near the Chuchupate Campground turnoff; the north slope of the San Gabriel Mountains between Big Pine and Wrightwood; and Gilroy Canyon in the Providence Mountains of the eastern Mojave Desert. June through August is the favored time of flight for the adults in all the above

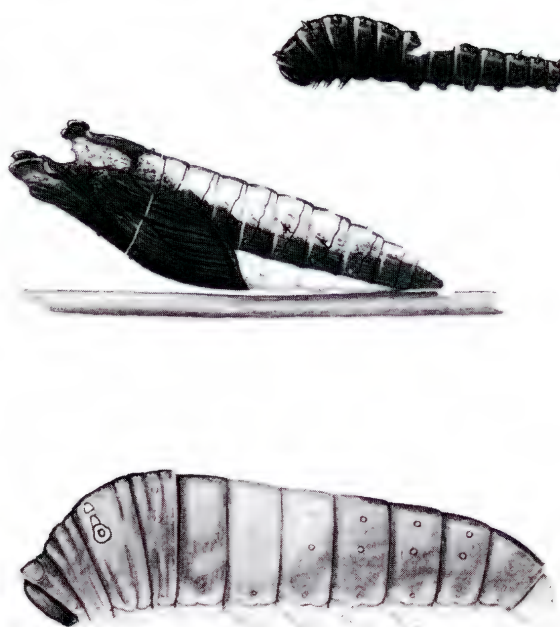


FIGURE 15. First instar—upper; pupa and mature larva—lower: *Papilio multicaudatus*. (Paintings by C. M. Dammers.)

localities except Gilroy Canyon, where adults fly in May. They are attracted to blooming Buckeye (or Horse-Chestnut), *Aesculus californicus* (Spach) Nutt., in the Tehachapis. Some of the specimens taken in the Tehachapis suggest hybrids of *multicaudatus* x *rutulus*.

Foodplants: Western Choke Cherry, *Prunus virginiana* L. var. *demissa* (Nutt.) Sarg. (Rosaceae), in the Tehachapi Mountains, and probably Ash, *Fraxinus anomala* Torr. ex Wats. (Oleaceae), in the Providence Mountains.

Early stages (text fig. 15): The mature larva is apple green, with thoracic markings similar to those described for *P. rutulus* and *P. eurymedon* (larvae of all three species are quite variable in the pattern of the eye spots of the fourth segment). The band across the front of the second abdominal segment is broad and velvety black, with a narrow yellow band just ahead of it on the posterior side of the first abdominal segment. Aepupua is stouter than those of the preceding two species and is dark greenish brown, with a black shaded dorsal region.

THE PIPEVINE SWALLOWTAIL

Battus philenor philenor (Linnaeus)

Plate I, figure 15

In our area of the state, *Battus philenor* is represented only by rare strays from Arizona and Mexico. To the north, native foodplants support numerous populations of a smaller and "hairy" subspecies,

Battus philenor hirsuta Skinner. We have records of typical *philenor* strays being taken in the desert areas and occasionally along the beaches in San Diego and Orange counties. Most specimens have been taken in the fall months (September and October) and perhaps they are blown in on easterly winds that prevail at this time of the year. Specific records are: San Clemente Beach, Newport Beach, Santiago Peak in the Santa Ana Mountains, Horse Thief Springs in the Kingston Range, and several localities in the New York Mountains.

Foodplants: No native *Aristolochia* (Aristolochiaceae) grow south of Monterey County in California. Perhaps if species of Pipevine (the sole foodplant of *Battus philenor*) were ever widely planted as ornamentals in our gardens, this beautiful swallowtail would become permanently established here.

Early stages (text fig. 13): The spherical egg is russet in color. The distinctive, blackish blue larva has orange fleshy tubercles and unbranched "spines" on each segment as shown in the figure. The odd-shaped pupa may be green or brown in ground color.

Family PIERIDAE

The pierids are small to medium-sized butterflies, commonly white or yellowish in color, bordered with black. Some species are bright orange. Others have greenish marbling on the undersides, produced by an intimate mixture of yellow and black scales. The common names of the members of this family—whites, sulfurs, orange-tips, and marbles—reflect these trends in pigmentation. Seasonal variation in color within the same species is not uncommon. The adults have six well-developed walking legs. The larvae of the whites, orange-tips and marbles feed primarily on members of the mustard family (Cruciferae), while those of the sulfurs usually feed on legumes such as *Cassia*, clover, and alfalfa (Leguminosae). All are cylindrical in body form, but many of the larvae have hairs or short tubercles and bristles. Many of the pierids are quite common and even abundant butterflies, and in Arizona and south into the tropics some species migrate in huge numbers at times.

THE PINE WHITE

Neophasia menapia menapia (Felder & Felder)

Plate 2, figures 1, 2

This delicate "white" flies in July and August but few collectors recognize it from other whites in *Neophasia*'s mountain strongholds. *Neophasia menapia* has been abundant in some years in the Tehachapi Mountains and may have been overlooked so

far in other areas. Adults of both sexes have a lazy, meandering flight, high among the branches of Ponderosa Pine (*Pinus ponderosa*). The males may be lured down by placing out dead specimens (with wings expanded) or even pieces of white paper, as decoy models on low branches or the ground.

Foodplant: Ponderosa Pine, *Pinus ponderosa* Dougl. ex P. & C. Lawson (Pinaceae). It is known to feed on other conifers such as Douglas Fir in other areas.

Early stages (no text fig.): The emerald green egg is flask-shaped and fluted on the sides. At the upper end is a circle of glistening white bead like knobs. The eggs are deposited by a female in rows at the base of pine needles. The mature larva is dark green with a broad white lateral band and a narrow white dorsal stripe. The anal segment terminates in two short tails, resembling a satyrid larva in this respect. The pupa, made at the base of the host tree, is dark green and striped with white.

BECKER'S WHITE

Pieris beckeri Edwards

Plate 2, figures 3, 4

Marbled in green on the underside and white and black above, *Pieris beckeri* is often a common sight throughout the desert areas and in cismontane southern California near the desert's edge (such as Mint Canyon, Bouquet Canyon, Frazier Park). It occurs in the south end of the San Joaquin Valley at the Cuyama River in Santa Barbara County, and 16 mi NW New Cuyama, San Luis Obispo County. In San Diego County, this white flies all the way to the coast. Captures are recorded from March to August and the butterfly goes through more than one brood in years when appropriate rainfall in the deserts provides the opportunity. Hovanitz (1962) notes that most of the distribution records for *Pieris beckeri* in southern California coincide with the known range of its bladderpod foodplant, but that some *P. beckeri* populations occur outside this host range.

Foodplant: Bladderpod, *Isomeris arborea* Nutt. (Capparidaceae), is the principal host in southern California; the butterfly occasionally uses introduced members of the Mustard family (Cruciferae), such as *Brassica nigra* (L.) Koch. Prince's Plume (*Stanleya pinnata* [Pursh.] Britton, Cruciferae) has been reported twice as a foodplant (Powell, 1957; Tilden, 1957a), and is likely the main foodplant in the eastern portions of our deserts.

Early stages (text fig. 16): The mature larva is greenish white with a marbling of gray dots and a bright orange belt between the segments. Numerous (16 or 18) jet black tubercles with black bris-

gles occur on each segment. The pupa is gray with whitish wing cases.

THE CALIFORNIA WHITE

Pieris sisymbrii sisymbrii Boisduval

Plate 2, figures 5, 6

The California White is always found in open, exposed habitats where there is high solar radiation; yet it prefers cool temperatures. Thus on the Mojave Desert and dry coastal hills of southern California it flies in the early spring months of February and March, but in the high mountains of our area it flies as late as April, May, and June. It is single brooded. Adults will hilltop.

Foodplants: *Caulanthus*, *Streptanthus*, and *Arabis* species (Cruciferae) are all used.

Early stages (text fig. 16): The long conical egg is yellow and bears many longitudinal ribs with cross ribs between them. The mature larva is basically light yellow, with several wavy stripes of black on each segment. The pupa is dark brown with abundant darker granulations.

THE COMMON WHITE

Pieris protodice Boisduval & Le Conte

Plate 2, figures 7, 8, 9, 10

This white is found everywhere in southern California, but reaches its greatest abundance in the

coastal areas and the deserts. It may be found from below sea level in the Imperial Valley to the highest peaks. The early spring form, "vernalis", has a distinctive, heavily mottled underside which differs from the lightly marked later broods. *Pieris protodice* flies from January to December, although it is commonest in the late spring. It is a hilltopper.

Foodplants: The native foodplant in the deserts is *Lepidium fremontii* Wats. (Cruciferae), and many other mustard species (*Cleome*, *Brassica*, *Sisymbrium*, etc.) are foodplants, including crucifers introduced from Europe.

Early stages (text fig. 16): The spindle-shaped egg is yellow. The mature larva varies in ground color from deep to pale blue-green, but always bears four longitudinal stripes of yellow. Black dots are thickly distributed over the entire body. The pupa is light bluish gray and is speckled with black.

THE CABBAGE WHITE

Pieris rapae (Linnaeus)

Plate 2, figures 11, 12

The Cabbage White is one of the most common butterflies in the cities and hills each spring and summer. It was introduced into eastern North America from Europe prior to 1860 and rapidly spread across the United States and much of Canada and Mexico. The species is scarce only in the

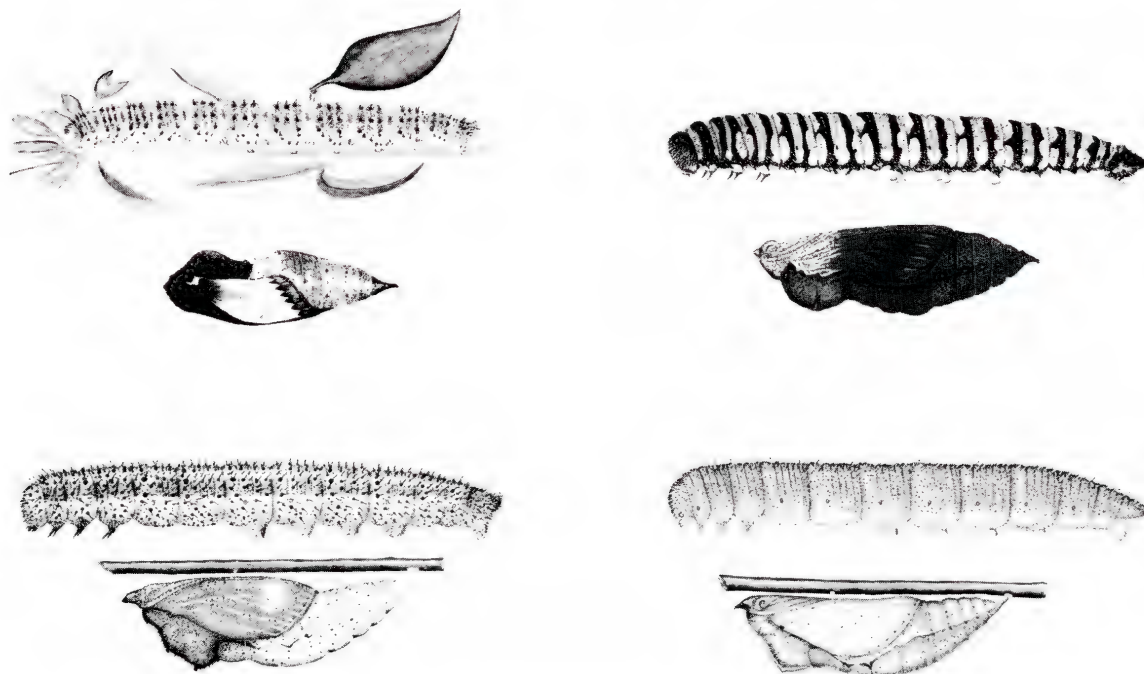


FIGURE 16. Mature larvae and pupae: *Pieris beckerii*—upper left; *P. s. sisymbrii*—upper right; *P. protodice*—lower left; *P. rapae*—lower right. (Paintings by C. M. Dammers.)

mountains and deserts. There is a remote possibility that the Spanish accidentally introduced this butterfly into California during the mission period, before the eastern populations could have spread to our state.

The females have two heavy forewing spots while the males bear just one (or, rarely, none). Many of the females, especially in the summer, bear a heavy ventral layer of dusky yellow scales. Near sea level in our area, *Pieris rapae* flies in every month of the year.

Foodplants: The Cabbage White feeds on a wide variety of cruciferous plants, including many garden vegetables or flowers (Cabbage, Kale, Mustard greens, Kohlrabi, Radish, *Nasturtium*, Stock [*Matthiola*], etc.).

Early stages (text fig. 16): The pearlike egg is yellow and is strongly ribbed longitudinally. The mature larva is pale green, with a yellowish dorsal stripe and a row of pale yellow spots on each side. The surface is finely dotted with black. The pupa varies from pale green to quite mottled gray or brown and is speckled with fine black dots.

THE ALFALFA SULFUR

Colias eurytheme eurytheme Boisduval

Plate 2, figures 13, 14, 15

A common sight in our agricultural areas, *Colias eurytheme* actually may be found almost everywhere in southern California. It flies from January to December, although mainly from February through late fall. The spring brood (form "ariadne") has narrow black borders and is almost entirely yellow, with a small central orange patch on each

wing. The late summer brood (form "amphidusa") has heavy black marginal borders and is deep orange in both sexes. At any time of the year, one will encounter albinic white females (form "alba") along with the normal female forms. This white color is controlled by a dominant gene (expressed only in the female).

Foodplants: Alfalfa, *Medicago sativa* L.; *Lotus scoparius* (Nutt.) Ottley; clovers, *Trifolium* species; and possibly several *Astragalus* species (all Leguminosae).

Early stages (text fig. 18): The whitish egg tapers from a broad center portion toward either end, and bears the usual longitudinal ribs and cross ribs of our pierids. The mature larva is dark green, with a basal white line (enclosing a narrow crimson line) and a subdorsal white line running along each side. Minute white hairs cover the entire body. The pupa is green with lateral yellow dashes and black markings.

THE YELLOW SULFUR

Colias philodice philodice Godart

Plate 2, figures 16, 17

While this is the most widely distributed of the many *Colias* species in North America, it has not gained a secure foothold in southern California. Perhaps the very hot, dry summers prevent its establishment in most localities. However, *Colias philodice* has recently been discovered at scattered points in the Imperial Valley area, and it will be of great interest to follow the movement of this species as it spreads to other parts of our half of the

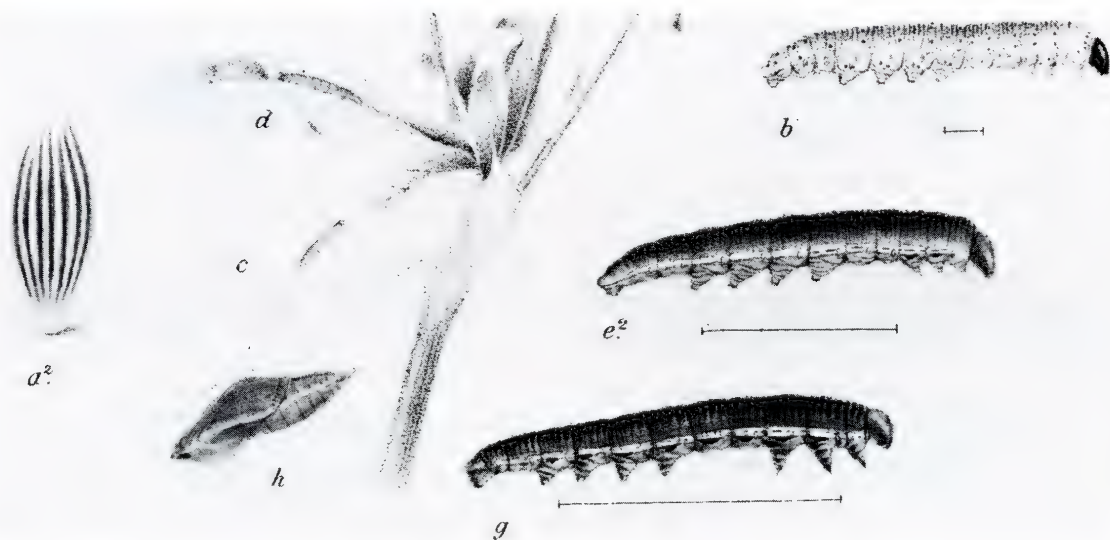


FIGURE 17. Egg, first instar (upper), fourth instar (center), mature larvae (lower), and pupa: *Colias philodice*. (From Edwards, 1884.)

state. The earliest confirmed record available to us is for the Holtville area in Imperial County, where Richard S. Funk found an established population on 8 June 1963.

Foodplants: Alfalfa, *Medicago sativa* L., and Clover, *Trifolium* species (both in the family Leguminosae).

Early stages (text fig. 17): The egg and pupa are as in *Colias eurytheme*. The mature larva is grass green with a whitish or pinkish stripe running along each side and a faint, darker green middorsal stripe. Occasionally, the body is pale yellow along the sides. Hibernation in eastern United States populations usually occurs in the pupal stage.

HARFORD'S SULFUR

Colias harfordii harfordii Hy. Edwards

Plate 2, figures 18-20

This yellow-colored sulfur is found in the coastal ranges and canyons of southern California, from San Diego County to Kern County. There is also one sight record for Keystone Canyon in the New York Mountains of the eastern Mojave which may refer to *Colias alexandra* from the north of this area. Aside from *Colias eurytheme* and *C. philodice* this is the only species of *Colias* in North America

known to have more than a single annual brood (Hovanitz, 1951). The first brood of adults begins emerging in March and flies in April to May, while the second brood emerges from late June to August. On the driest mountainsides during the summer, one can still find these golden yellow butterflies sipping nectar from mints and thistles.

The range of this *Colias* apparently does not go north of the Tehachapis into the Sierra Nevada or much north of Santa Barbara County in the coastal mountains. Interestingly, the range of its larval foodplant extends much farther north, to San Benito County. The very early spring specimens show heavier black scaling on the undersides and are probably best referred to as form "barbara" (at times considered a subspecies of *Colias harfordii* in the Santa Barbara area). Oakley Shields states that there is also a distinctive and rare spring form flying from February to March in San Diego County, near Jacumba and Scissors Crossing. It is a large, bright yellow butterfly with dusky green undersides. No name has been given to this San Diego form as yet.

Foodplant: Rattleweed, *Astragalus douglasii* (T. & G.) Gray and *A. douglasii* var. *parishii* (Gray) Jones (family Leguminosae). A female was observed

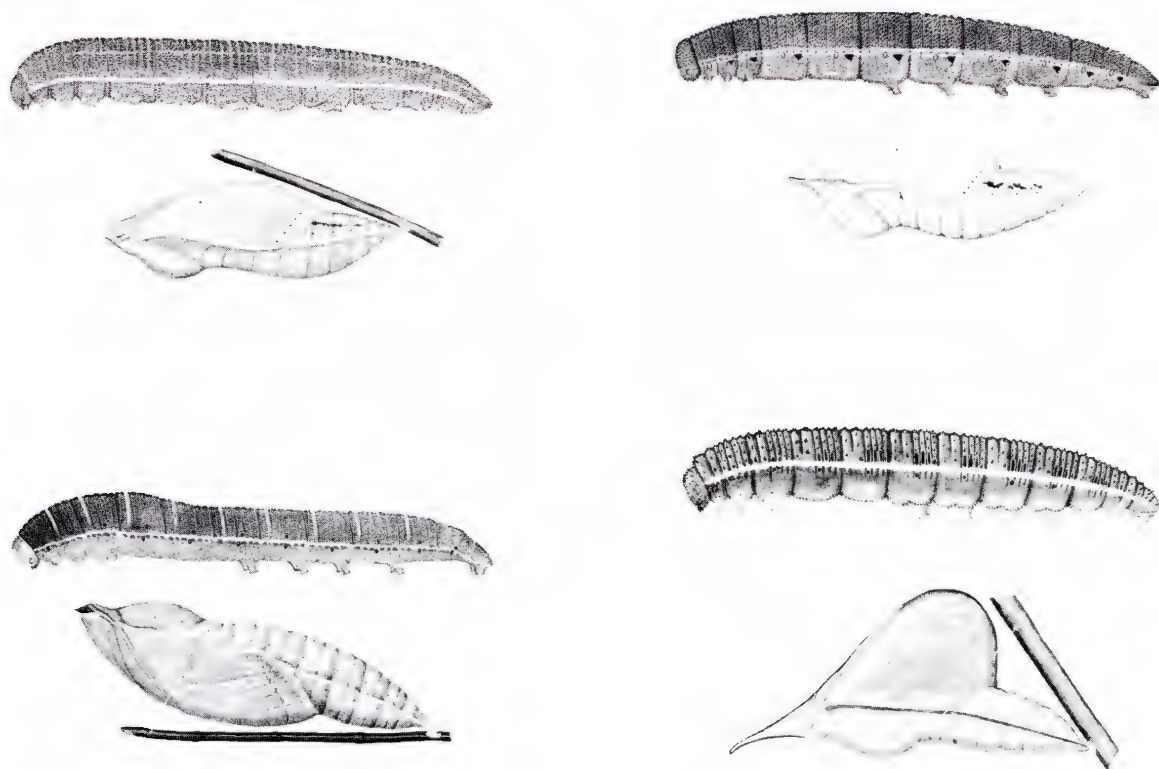


FIGURE 18. Mature larvae and pupae: *Colias eurytheme*—upper left; *C. harfordii*—upper right; *C. eurydice*—lower left; *Phoebis sennae marcellina*—lower right. (Paintings by C. M. Dammers.)

by J.F. Emmel ovipositing on *Lotus scoparius* (Nutt.) Ottley near Sandbergs on the old Ridge Route, but otherwise this butterfly is only known to feed on *Astragalus* species.

Early stages (text fig. 18): The egg is yellow-green and similar in shape to others of the genus. The mature larva is green and bears a lateral white stripe enclosing a vermilion line. Minute black tubercles bearing short hairs are scattered over the body. The pupa is basically yellow-green, with a yellowish abdomen and a bright yellow band (containing a red line) on the sides of the abdomen.

THE CALIFORNIA DOGFACE

Colias (Zerene) eurydice Boisduval

Plate 2, figures 21-23

The California Dogface may be found in the mountains and foothills from central California to southern San Diego County. Unlike the following species, it is not found in the desert areas. Both sexes are fast-flying, agile butterflies but are avid flower-visitors (especially to purple flowers) and may be easily netted while sipping nectar. The freshly emerged male has a beautiful violet iridescent sheen on its forewings. Both sexes exhibit considerable variability in black pattern elements. The black band of the male often extends into the margin of the hindwings; this is called form "bernardino." The California Dogface is our official state butterfly, designated as such by the California Legislature in 1972, more than 30 years after Jean Gunder proposed this recognition.

The adults appear in two broods, the spring generation flying mainly in April and May and the summer brood flying abundantly from late July to September. A few late-emerging specimens are caught into November. The latter generation is particularly common in the resort areas of the San Bernardino Mountains, where it flies in brilliant golden splendor among the dried brown grasses and blooming thistles of the open meadows.

Foodplant: False Indigo, *Amorpha californica* Nutt. (Leguminosae).

Early stages (text fig. 18): The spindle-shaped egg is yellow-green. When mature, the dull green larva is marked with a white lateral line edged ventrally with orange and dorsally with a black spot or thin cross-band in each segment. The pupa is pale green.

THE SOUTHERN DOGFACE

Colias (Zerene) cesonia (Stoll)

Plate 2, figures 25, 26

The Southern Dogface bears dark wing margins in both sexes and lacks the violet sheen of the males

in the preceding species. It is sporadically taken in the deserts and in cismontane southern California adjacent to the deserts. Adults have been taken in fair numbers in the New York Mountains in June, in the Providence Mountains from April to May, in the Chuckwalla Mountains in March, and in the desert areas of San Diego County in May and again in September to October. Langston records it two mi N Lakeside, San Diego Co. in mid-May, and other fresh coastal and lower montane specimens have been noted in the month of April. The species is probably a migrant from Arizona and Mexico which becomes temporarily established each year.

Comstock (1927a) figures several "aberrant" forms of *C. eurydice* which may in some cases represent hybrid adults from wild crosses with *C. cesonia*. Both species are found in the San Bernardino Mountains and other areas where these intermediate specimens have been collected. *C. eurydice* occurs alone in northern California and these odd specimens are lacking there.

Foodplants: Hosts in southern California have not been determined yet, but elsewhere *C. cesonia* is known to feed on *Amorpha* (False Indigo), *Parosela* and *Trifolium* (Clover), all Leguminosae.

Early stages (no text fig.): The green larva is densely covered with small blackish tubercles, each bearing many short hairs. The green ground color may be unmarked, or bear either cross-bands or lengthwise stripes of yellow and black. In other states, the species is known to hibernate in the pupal stage.

THE CLOUDLESS SULFUR

Phoebis sennae marcellina (Cramer)

Plate 2, figures 27, 28

The Cloudless Sulfur was a common butterfly in earlier days in our area from San Diego to Santa Barbara. Comstock could state in 1927 that "This brightly colored and agile butterfly is a familiar sight as it dodges through the gardens and parks of southern California, in search of the yellow *Cassia* blossoms.... It flies from February to December, and there is probably a succession of broods to account for its extended season." Langston states (*in litt.*) that it was still common in 1941 and flew from April to December. But, for reasons we do not yet understand, this beautiful butterfly has gone the way of many another wild creature in our cities. Perhaps the increasing levels of smog contained a pollutant chemical that finally reached injurious levels for this species, and like the yellow canary carried down into the mines by coal miners of former days, its demise served to warn us of a change in air quality.

Today *Phoebis sennae* is probably not a permanently established breeding resident anywhere in southern California (save perhaps at El Cajon near San Diego), and it is considered a rather rare and desirable capture among lepidopterists. Bruce Griffin comments that the species is scarce in Orange County and that, as elsewhere, it will go through a generation on its *Cassia* foodplants in the summer months but does not overwinter there. The Cloudless Sulfur has been taken in desert canyons from Chino and Whitewater canyons east to the Providence Mountains in April and May, and very occasionally in coastal areas during the summer.

Foodplant: *Cassia* species (Leguminosae), introduced from the American tropics (in our cities); in the deserts, the native species *C. armata* and *C. covesii* could serve as foodplants.

Early stages (text fig. 18): The orange-yellow egg is somewhat spindle-shaped. The mature larva may be either green or yellow, with minute black nodules densely scattered over the surface. A yellow lateral stripe, bordered above with blue points, runs the length of the body. The pupa varies from a sheer pink to a vivid green, and bears a yellow lateral stripe bordered ventrally with green. The antennal sheaths are yellow, and the wing veins are outlined in green.

THE LARGE ORANGE SULFUR

Phoebis agarithe agarithe (Boisduval)

Plate 2, figures 29, 30

A large, pure orange *Phoebis* found rather commonly in southern Arizona and Mexico, the Orange Sulfur has been taken by collectors from time to time in the eastern deserts of California. The best documented records are from the Providence Mountains, San Bernardino County (September) and the Bard area, Imperial County (early October). There is one old record for Santa Barbara (Richard Priestaf). It is not a breeding resident at present.

Foodplant: *Cassia* species (Leguminosae) in Costa Rica, and probably elsewhere in its range.

Early stages (no text fig.): Undescribed for any United States population.

THE MEXICAN YELLOW

Eurema mexicana (Boisduval)

Plate 2, figures 31, 32

An occasional capture in southern California, this tropical species apparently re-invades our area each year from permanent populations in Arizona and Mexico. Freshly emerged specimens in the late summer may indicate a second brood partially composed of locally produced adults (resulting from eggs laid on *Cassia* by spring migrants). The Mexican Yellow has been collected occasionally in the spring on the desert side of the mountains in San Diego County and once at El Cajon on the coast. It has been taken in September at Bard (Imperial County), Earp (San Bernardino County), Balboa Island (Orange County), the Barton Flats area of the San Bernardino Mountains, and at 4000 ft elevation at Mountain Center in the San Jacinto Mountains, Riverside County. During March and April, *Eurema mexicana* rather regularly appears in the canyons of the Providence Mountains. The short triangular tails on the hindwings readily distinguish this species from our other pierids.

Foodplant: Senna, *Cassia* species (Leguminosae).

Early stages (no text fig.): Not known in detail, despite the commonness of the species in Mexico and Central America.

THE NICIPPE YELLOW

Eurema nicippe (Cramer)

Plate 2, figures 35, 36

The Nicippe Yellow is found throughout lowland southern California in populated areas and in the deserts. The northern limit of its range is Santa Barbara. It used to be very common in Los Angeles until about 1960 and seems to have been reduced in numbers since that date. In the cities its foodplants are introduced *Cassia* species. On the deserts it probably uses the two native *Cassia* species. Sometimes large fall broods occur in the deserts,



FIGURE 19. Mature larvae and pupae: *Eurema nicippe*—left; *Natholis iole*—right. (Paintings by C. M. Dammers.)

following summer rains. The normal flight period extends from February to November; most captures are recorded from April to August and September, while Langston records the species for every month of the year in Huntington Park, Los Angeles.

Foodplant: *Cassia* species (Leguminosae) and probably other Leguminosae.

Early stages (text fig. 19): The spindle-shaped egg is lightly ribbed with longitudinal lines and is light greenish-yellow in color. The velvety green mature larva bears a thin, whitish yellow lateral stripe. The pupa is olive green.

THE DWARF YELLOW

Nathalis iole Boisduval

Plate 2, figures 33, 34

This diminutive butterfly is the smallest of our pierids. It flies rapidly but near the ground, and visits flowers where it may be easily captured. The male sports a distinct black sex patch on the upper surface of the hindwing.

In California *Nathalis iole* is sometimes common in the agricultural areas of Imperial County and the desert areas and coastal lowlands of San Diego, Orange, Riverside, and San Bernardino counties. It is occasionally taken as a stray in unusual locations such as high elevations in the mountains, especially in late summer. Captures have been recorded from March to October. Dammers recorded the life history from immatures taken in Orange County at mid-October.

Foodplant: Beggar-tick or Bur Marigold, *Bidens pilosa* L. (Compositae). The larva will also feed on Garden Marigold (*Tagetes*).

Early stages (text fig. 19): The mature larva is generally dark green with adjacent blackish and yellow stripes along each side and a broad purple dorsal stripe. A pair of short, reddish conical tubercles covered with bristles project forward on the prothorax. The green pupa lacks the frontal projection from the head that is characteristic of our other yellows and sulfurs.

FELDERS' ORANGE-TIP

Anthocharis cethura (Felder & Felder)

Felders' Orange-tip occurs as three races in our area:

(a) FELDERS' ORANGE-TIP

Anthocharis cethura cethura (Felder & Felder)

Plate 2, figures 37-41

In a spring with good rainfall, out on the arid stretches of the Mojave and Colorado deserts from Kern to Inyo counties south to San Diego County, one may find this rare Orange-tip. The Little Rock Dam area near Palmdale supports large populations of the typical *A. c. cethura* subspecies, and one can occasionally capture the forms "deserti" Wright (the orange spot is much reduced or absent) and "morrisoni" Edwards (the ventral green mottling is very heavy and even may be solid). Langston notes (*in litt.*) that populations with numbers of "morrisoni" are generally those in the cooler northern part of the range of *A. cethura*, such as in the Panamint Mountains and Grapevine Mountains in Inyo County and Red Rock Canyon in Kern County (all flight records in April). In various populations one occasionally finds the yellow tinted form "caliente" Wright. These Orange-tips fly from late February to early April.

(b) THE PIMA ORANGE-TIP

Anthocharis cethura pima Edwards

Plate 2, figures 42, 43

A second subspecies, *A. cethura pima*, has a deep yellow suffusion over its wings, and is found in extreme eastern California (Providence and New York mountains, and the area across the Colorado River from Yuma, Arizona) as well as in Arizona.

(c) THE CATALINA ORANGE-TIP

Anthocharis cethura catalina Meadows

Plate 2, figures 44, 45

The third subspecies in southern California, *A. cethura catalina*, occurs only on Santa Catalina Island off the coast. It was described in 1936 from specimens taken in earlier years at Grand Canyon,



FIGURE 20. Mature larvae and pupae: *Anthocharis sara*— left; *A. cethura*—right (insert, dorsal view of larva). (Paintings by C. M. Dammers.)

White's Landing, Renton Mine, Salte Verde, and Little Harbor. The collector (Meadows, 1936) states "Probably the most accessible locality where *catalina* may be collected is a small, open meadow at the top of a ridge between the Renton Mine and Jewfish Point, two miles south of Avalon, at the head of Pebbly Beach Canyon. It flies from late March to mid April." This rare subspecies has not been taken for many years and may be extinct. The distinctive features of *A. cethura catalina* are the lighter ventral markings, a more chalky white dorsal surface, and a pale creamy yellow apical spot instead of orange yellow as in typical *cethura*. All subspecies of *cethura* are strong hilltoppers.

Foodplants: *Streptanthella longirostris* (Wats.) Rydb., *Descurainaea* spp. (Cruciferae). Probably other native mustards are used but these are poorly known. Larvae will feed on the introduced European *Sisymbrium* mustards in the laboratory.

Early stages (text fig. 20): The orangeish egg is spindle-shaped and bears about seventeen straight, sharply elevated, longitudinal ribs with numerous cross lines between the ribs. The mature larva is beautifully marked with broad white lateral patches and rows of shiny black dots on cross bands of orange-yellow and green. There are progressive spectacular changes in coloration with maturation of the last instar larva (Comstock & Dammers, 1932). The pupa is light brown to mottled blackish gray, with many darker striations and a long beak-like palpal case at the front of the head.

THE SARA ORANGE-TIP

Anthocharis sara Lucas

There are three subspecies of the Sara Orange-tip, including the typical, in our area:

(a) THE SARA ORANGE-TIP

Anthocharis sara sara Lucas

Plate 3, figures 1-4, 7

A beautiful sprite of the springtime, the Sara Orange-tip occurs throughout southern California in the foothills and mountains and even the desert edge. It displays considerable color variation. The early spring brood of typical *A. sara sara*, named form "reakirtii" by Edwards, flies from February to early April and is a small orange-tip with heavy green mottling on the ventral surface. The late spring brood, the form of typical subspecies *sara*, flies in May and June and is larger, with reduced green mottling beneath and lighter black markings above. Evans (1952) showed that *sara* is the late spring brood resulting in as little as 16 days from part of the eggs laid by "reakirtii" females; the larvae from the rest of the eggs pupate but then diapause as pupae until early the following spring, when they emerge as new "reakirtii" adults.

As Comstock (1927a) aptly says, "This beautiful spring butterfly never fails to bring a thrill of delight to the lepidopterist, as it pursues its impetuous course through our wooded canyons, or sports over the mustard-spangled foothills in search of *Arabis* or *Raphanus* on which to oviposit. It is found at practically all altitudes, but seems to prefer the foothill country and adjacent meadowlands." A yellow suffusion may cover the upper surfaces of *A. sara* individuals, especially in montane populations; this was named form "stella" by Edwards.

(b) THE THOOSA ORANGE-TIP

Anthocharis sara thoosa Scudder

Plate 3, figures 5, 6

In the extreme eastern Mojave Desert, a race named *Anthocharis sara thoosa* Scudder reaches our area from the desert areas of southern Utah, Nevada, and northern Arizona. It flies in the Old Woman, Providence, New York, Clark, and Kingston mountains in April. It resembles *A. sara* "reakirtii" but has a narrower, deeper orange forewing patch, a broad, dark brown forewing border, and ventrally the greenish yellow of typical *sara* is replaced by grayish brown scaling. The name *inghami* Gunder, which has been applied to these eastern Mojave populations from time to time, is named from Tucson and Globe, Arizona, and has a different phenotype, including uniformly dense, dark olive green undersides.

(c) GUNDER'S ORANGE-TIP

Anthocharis sara gunderi Ingham

Plate 3, figures 8, 9

Finally, on Santa Catalina and Santa Cruz Islands off the coast, the race *Anthocharis sara gunderi* is plentiful from the end of December until March and then the second brood of larger, more typical "*sara*" emerges until early May. The early brood is smaller than most of the adults of the mainland spring form, "reakirtii." The males bear an especially heavy black bar below the apical patch and in both sexes, the greenish black marbling on the underside of the hindwings is dense and evenly distributed. The females have a very dark apical area (the white spots above the orange spot in "reakirtii" are almost completely covered with black) and the hindwings are flushed with a greenish yellow tinge.

Foodplants: The host of *A. sara thoosa* in our area is *Arabis perennans* Wats. (Cruciferae). The other races of *sara* feed on various *Arabis* mustards, including *A. sparsiflora* Nutt. var. *arcuata* (Nutt.) Roll., *Barbarea vulgaris* (L.), *Brassica kabera* (D. C.), *Descurainaea* sp., and *Sisymbrium officinale* (L.) Scop. (see Opler, 1967, for detailed records). The species occasionally feeds on *Dentaria californica*.

nica in the San Francisco Bay area. Dammers records it on *Sisymbrium pinnatum* (Walt.) Green.

Early stages (text fig. 20): The yellow (fresh) to deep orange (mature) egg is 2 mm tall and spindle-shaped, with 16 to 18 longitudinal ridges and very fine cross ridges (Comstock, 1931). The mature larvæ of "reakirtii" is basically green with a poorly defined middorsal green line and a dorsal surface tinged with dirty yellow and numerous black blotchings. Transverse rows of black papillae extend to the wide, yellowish white lateral line, which is bordered below by a darker green area. The pupa is light brown, with darker brown spots and markings. A dark middorsal band is present, as well as the lateral white and dark lines shown in the accompanying figure.

GRINNELL'S MARBLE

Anthocharis lanceolata australis (Grinnell)

Plate 3, figures 10, 11

In our lower mountain areas up to at least 5500 ft elevation, this rather scarce, delicately marked white *Anthocharis* may be found often flying with the common orange-patched *A. sara* during the spring months. It is single brooded and normally flies from March to May, depending upon elevation, although occasional specimens have been taken in February (Sentenac Canyon, San Diego County) and July (near Camp Angeles, San Bernardino Mountains). Usually found in wooded canyons with high walls (e.g., Little Rock Dam, Big Tujunga, Elizabeth Lake, and San Gabriel and Bear canyons, Los Angeles County), it is also found at the foothill edge of the Colorado Desert at Scissors Crossing and west of Jacumba, San Diego County. The northern records in our area are along the Kern

River, Kern County (Langston). An occasional wild hybrid between *A. lanceolata* and *A. sara* is taken; this form was named "dammersi" by Comstock.

Foodplants: *Arabis perennans* Wats. along the edge of the Colorado Desert; in other areas, *A. sparsiflora* Nutt. var. *arcuata* (Nutt.) Roll., according to Comstock (1927a) (both Cruciferae).

Early stages (text fig. 21): The mature larva is green with minute flecks of white and a wide white lateral line. A pair of green papillae occurs dorsally on each segment. The pupa is slaty gray-brown and has a palpal case strongly curved above the head.

THE HYANTIS MARBLE

Euchloe hyantis (Edwards)

There are two subspecies of the Hyantis Marble regionally:

(a) THE SOUTHERN MARBLE

Euchloe hyantis lotta (Beutenmüller)

Plate 3, figures 12-14, 17, 18

The Southern Marble flies in the spring on the Mojave Desert and in the Coachella Valley, appearing even in February around Palm Springs. Late March and early April represent the peak of the flight season for the more northern Mojave populations; some adults last into early May. The species is single brooded. It has been taken from Little Rock Canyon and Palmdale east to the Providence Mountains. Opler (1968, 1969) identifies two additional segregates of this butterfly that have not been formally named as yet: the Mt. Pinos Block segregate, which flies from Lebec in Kern County to Cuyama in Ventura County, and the Peninsular Ranges segregate, which occurs from the San Jacinto Mountains south to the Laguna Mountains, along the western edge of the Colorado Desert in Riverside and San Diego counties, and south into the mountains of northern Baja California. The butterflies commonly "hilltop."

(b) MARTIN'S MARBLE

Euchloe hyantis andrewsi Martin

Plate 3, figures 19-21

MARTIN'S MARBLE is an isolated race inhabiting the higher elevations of the San Bernardino Mountains. Its principal distinguishing features are the very rounded apex, the lack of dark scaling at the base of the wings, and the very light yellow-green marbling as well as no pearly luster on the ventral surface of the hindwings (Martin, 1936). The type locality is the Crestline Highway near Lake Arrowhead. Specimens have also been taken near Big Bear Lake and on other brushy slopes between 5000 and 6000 ft elevation. This rare butterfly flies from June to early July in a single

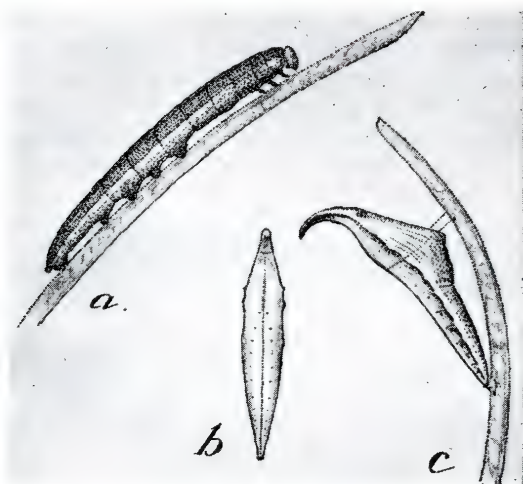


FIGURE 21. Mature larva and pupae: *Anthocharis lanceolata australis*. (From Comstock, 1927a.)

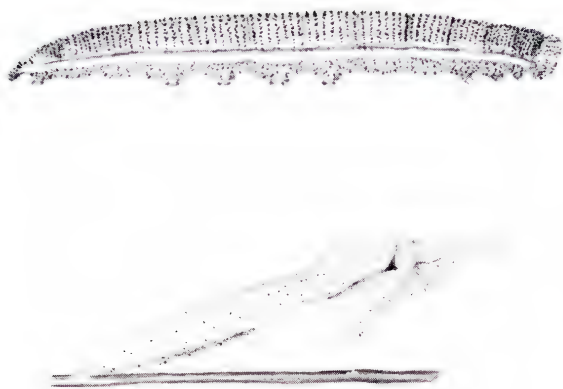


FIGURE 22. Mature larva and pupa: *Euchloe hyantis lotta*. (Paintings by C. M. Dammers.)

brood. A phenotypically distinct, high altitude population of *E. hyantis* near *lotta*, which feeds on *Descurainea*, is found close to *andrewsi* populations near the eastern end of the San Bernardino Mountains. The butterfly has been reared by Henne from larvae taken on seed capsules of *Descurainea richardsonii* Schulz at Green Canyon.

Foodplants: For *E. hyantis lotta*, various species of mustards (Cruciferae), including *Streptanthus* spp., *Caulanthus* spp., *Descurainea* spp., occasionally *Arabis* spp., and *Lepidium fremontii* Wats. For *E. hyantis andrewsi*, only two hosts are known: *Streptanthus bernardinus* (Greene) Parish and *Arabis holboellii* Hornem. var. *pinetorum* (Tides.) Roll.

Early stages (text fig. 22): Described by Comstock and Dammers (1932) from Mojave Desert material, the life stages pass through in about 20 days from the emergence of the egg to pupation. As with the single brooded *Anthocharis*, diapause and hibernation is in the pupal stage. The egg is similar to that of *Anthocharis* and is lemon yellow in color. The eggs hatch three days after laying. The mature larva is green and is covered with

raised purplish punctae, each bearing a short dark bristle. There is a wide lateral line, creamy white in color and bordered above with a purplish band. A faint brownish or purplish middorsal stripe is also present. The larva feeds only on the seed pods of the host. The pupa varies in color from a light straw to dark wood brown.

Family DANAIDAE

The danaids are large and usually brownish colored butterflies, marked with black and white patterns. The front legs are very small, lack claws, and are not used in walking. The family is well developed in the tropics of both the Old and New World, but only two species penetrate our subtropical area of southern California. Our species feed on milkweeds as larvae, from which they obtain protective distasteful chemicals that repel potential predators.

THE MONARCH

Danaus plexippus (Linnaeus)

Plate 3, figure 27

The Monarch is a familiar butterfly throughout southern California. Although it is more commonly taken in coastal, lowland, and foothill areas where its milkweed foodplants tend to be more abundant, it flies on the deserts as well as the mountain peaks. The adults may be seen in all months of the year in coastal areas, although they are relatively inactive and not in breeding condition during the winter.

This butterfly is a renowned migrant. During the fall adults fly south from throughout western North America to overwinter on the California coast, from the Monterey area south to San Diego, and in Mexico. Only a few California sites (e.g., Pacific Grove) support great concentrated numbers of the overwintering adults on trees; usually the adults hibernate as scattered individuals or in small clusters. In the spring, the adults leave their winter roosting sites singly and move north along the central valleys and east into the deserts and mountain areas.

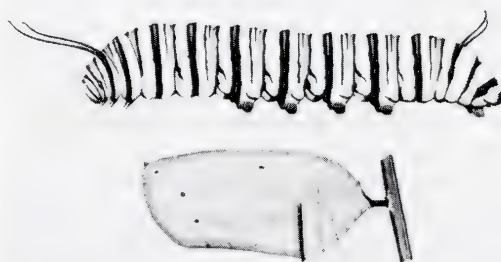


FIGURE 23. Mature larvae and pupae: *Danaus gilippus strigosus*—left; *D. plexippus*—right. (Paintings by C. M. Dammers.)

After laying their eggs, these six-to-nine-month-old adults die. Several generations pass before the cold fall weather prompts another southward migratory movement of a new group of late-emerging adults which will pass the winter along the coast.

Foodplants: Milkweeds in the genus *Asclepias* (Asclepiadaceae). In southern California, *Asclepias fascicularis* Dene. in A.D.C. and *A. eriocarpa* Benth. are both widely used. Undoubtedly most other *Asclepias* in the area are used as well.

Early stages (text fig. 23): The tropical Monarch is incapable of overwintering in any stage where freezing temperatures occur and the adults apparently are the only life-cycle stage that can survive the cool temperatures of our southern California coastal areas. From spring to fall, though, the butterfly passes through several broods, and the life history is familiar to most naturalists. The egg is a delicate pale green. The mature larva is greenish in ground color, with transverse bands of black and yellow and two dorsal pairs of fleshy black filaments. The pupa, which hangs vertically from the cremaster at the tip of the abdomen, is pale green with raised, metallic gold spots.

THE STRIATED QUEEN

Danaus gilippus strigosus (Bates)

Plate 3, figure 26

Less common than its sister species, the Striated Queen breeds in the desert areas, especially the Colorado Desert. Stray adults can be taken throughout the cismontane areas of San Diego and Riverside counties, and as far north as Mono County in the arid regions east of the Sierra Nevada. Occasional specimens show up in the fall in coastal sections from San Diego to Los Angeles and even to Los Prietos in Santa Barbara County. Adults have been taken from early April to November in southern California.

Foodplants: *Sarcostemma hirtellum* R. Holm (Rambling Milkweed) and probably *S. cynanchoides* ssp. *hartwegii* (Vail) R. Holm. These are both vines in the family Asclepiadaceae that ramble over shrubs; superficially they do not resemble milkweeds at all. Larvae have also been taken on flowers of *Asclepias albicans* Wats., a tall (up to 6 feet!), virtually leafless milkweed that grows in rocky places in the Colorado Desert. Chris Henne has taken larvae on *Asclepias erosa* Torr.

Early stages (text fig. 23): The egg is pale green. The mature larva is whitish violet, with adjacent transverse stripes of a deeper purplish, reddish brown and yellow. The three pairs of brownish purple filaments arise dorsally from the mesothoracic, 2nd and 8th abdominal segments. The green pupa has gold dots between the 4th and 5th abdominal segments.

Family SATYRIDAE

Small to medium sized butterflies, the satyrs reach their greatest diversity in the tropics and characteristically inhabit forest areas there—hence their name. Our temperate zone fauna of Satyridae in North America is quite sparse, compared to even the northern Old World areas. Most American species are high mountain or arctic butterflies and thus do not occur in southern California. Almost all species are grayish or brown in color, have eye-like spots (ocelli) on the wings, and usually have the forewing veins swollen at the base.

THE CALIFORNIA RINGLET

Coenonympha californica californica Westwood

Plate 3, figures 23-25

The California Ringlet flies in great but inconspicuous abundance in the grassy lowlands of southern California. Its low bobbing flight and somber mothlike colors attract little attention except from keen eyed lepidopterists. It may be found throughout our area in grassland or oak woodland habitats, except in the Colorado and Mojave deserts. The flight period extends from February to October in lowland areas; emergence begins later

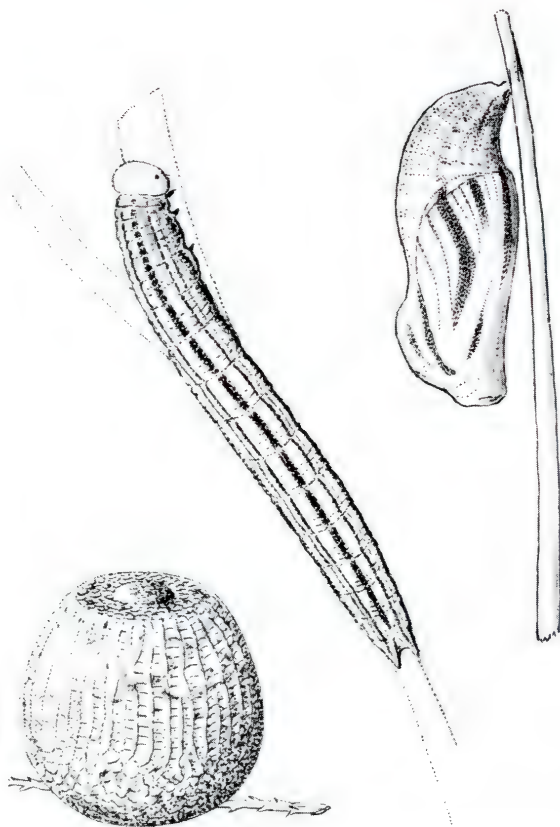


FIGURE 24. Egg, mature larva and pupa: *Coenonympha californica californica*. (From Comstock, 1927a.)

with increasing altitude. As many as three annual broods occur in the coastal hills and lower mountain slopes. The late summer and autumn generation, called "galactina" by Boisduval, is distinguished by its creamy yellow dorsal surfaces and brownish yellow ventral pattern with small ocelli; the spring broods are whitish dorsally and have slaty gray undersides.

Foodplants: Grasses, both native and introduced species, although no specific host has been identified in previous publications.

Early stages (text fig. 24): The yellowish egg changes to ivory with brownish streaks as it matures. The mature larva is olive green or brown in coloration and is marked with light and dark longitudinal stripes as shown in the accompanying figures. The pupa may be green or brown in ground color. The entire life cycle can pass in three weeks in the laboratory.

THE STHENELE SATYR

Cercyonis sthenele (Boisduval)

Two satyrs, representing distinct subspecies of *sthenele*, occur in our area:

(a) THE SYLVAN SATYR

Cercyonis sthenele silvestris (Edwards)

Plate 3, figures 15, 16

This medium sized satyrid is a common sight during the summer months in cismontane southern California. It especially frequents grassy oak dotted slopes. Males fly at their peak in June and females are more abundant in July. A few worn specimens are taken as late as September. A great many records have been reported from sites in the Tehachapi and Greenhorn mountains and the Frazier Park-Mt. Pinos areas in Kern and Ventura counties, but the species is also abundant from the Santa Monica Mountains in Los Angeles County to the Laguna Mountains of San Diego County. It frequently is found feeding on Horse Chestnut blossoms in the Tehachapis. The distinguishing features of this subspecies of *C. sthenele* (see Emmel, 1969) are the generally uniform dull brown mottling of the undersides and the lack of ocelli on the hindwings.

(b) THE LITTLE SATYR

Cercyonis sthenele paulus (Edwards)

Plate 3, figure 22

Far out in the eastern Mojave Desert, a second subspecies, *Cercyonis sthenele paulus* barely reaches our area. Widely distributed in the Great Basin states of western North America, *C. s. paulus* is also found in the Pinyon-Juniper Zone of the Ivanpah, New York and Clark mountains, in the



FIGURE 25. Pupa—upper left; mature larva—upper right: *Cercyonis sthenele silvestris*. Mature larva—bottom: *C. s. paulus*. (Photographs by T. C. Emmel.)

Kingston Range, eastern San Bernardino County, and in the Argus and Panamint mountains, Inyo County. It is readily distinguished by the large amount of frosted white scaling and strongly contrasting striations on the ventral surface of the hindwings. A well-developed series of up to six prominent ocelli is also present on the hindwings. It flies in late June and July. These populations of dark adults may actually differ enough from true Great Basin *paulus* to be considered a separate subspecies. The butterfly also should be expected in the Old Woman and the Providence mountains.

Foodplants: Grasses; specific species not published.

Early stages (text fig. 25): The barrel-shaped, ribbed egg is whitish in color. The mature fifth-instar larva is grass-green with a dark middorsal stripe and a yellow lateral stripe (white in *C. s. paulus* larvae). The pupa is grass green in color.

Family NYMPHALIDAE

The butterflies in this family have greatly reduced forelegs, without tarsal claws, and walk on only the middle and hind legs. Some taxonomists include the Danaidae, Satyridae and Libytheidae in the family Nymphalidae because they also share this character. Most species are medium to large

butterflies with brown and black patterned wings. The larvae are often spiny and feed on a variety of plant families. The pupa is usually suspended by the cremaster at the tip of its abdomen.

THE GULF FRITILLARY

Agraulis vanillae incarnata (Riley)

Plate 3, figure 28

The silver-spangled Gulf Fritillary is a common insect in the urban areas of southern California, where it breeds throughout the year except perhaps in mid-winter. The larvae feed on introduced passion flowers which are used as ornamental vines. In recent years, this tropical butterfly has penetrated as far north as San Francisco Bay; hard freezes still kill off these northern populations in years with cold winters. *Agraulis* is quite abundant in Los Angeles from May to October. The most unusual distributional record is from Gilroy Canyon in the Providence Mountains (15 May 1968, by Griffin), since no suitable food plant should occur there. The spectacular silver spots and beautiful magenta forewing flush on the underside make this bright orange butterfly one of our loveliest species and the ease of rearing adults from even the egg stage render the species a favorite for classroom demonstrations of insect life cycles.

Foodplants: Passiflora incarnata, P. caerulea, and

other introduced *Passiflora* species (Passifloraceae).

Early stages (text fig. 26): The yellow egg has 18 to 20 longitudinal ribs. The mature larva is slaty gray with burnt orange stripes and black branching spines. The convoluted pupa is mottled with whitish gray, brown and black. The species does not diapause in any stage but in seasonally cold weather it can slow its larval growth and survive brief periods of near freezing temperatures.

THE VARIEGATED FRITILLARY

Euptoieta claudia (Cramer)

Plate 3, figure 33

This is a rare capture in southern California, though its major foodplants in the Gulf states and the tropics are the same introduced passion flowers as the Gulf Fritillary uses. It has been taken occasionally in September in the Scissors Crossing area of San Diego County, and in the Providence Mountains and New York Mountains (Keystone Canyon, 1 June 1968), San Bernardino County. In similar habitats in southern Utah, *Euptoieta claudia* uses a small (often less than three inches tall) flax species (*Linum rigidum*, family Linaceae) as a host, and a very closely related flax, *Linum puberulum* (Engelm.) Heller grows in pinyon-juniper woodland in the New York and Clark mountains. In early September 1936, Lloyd Martin found a rather

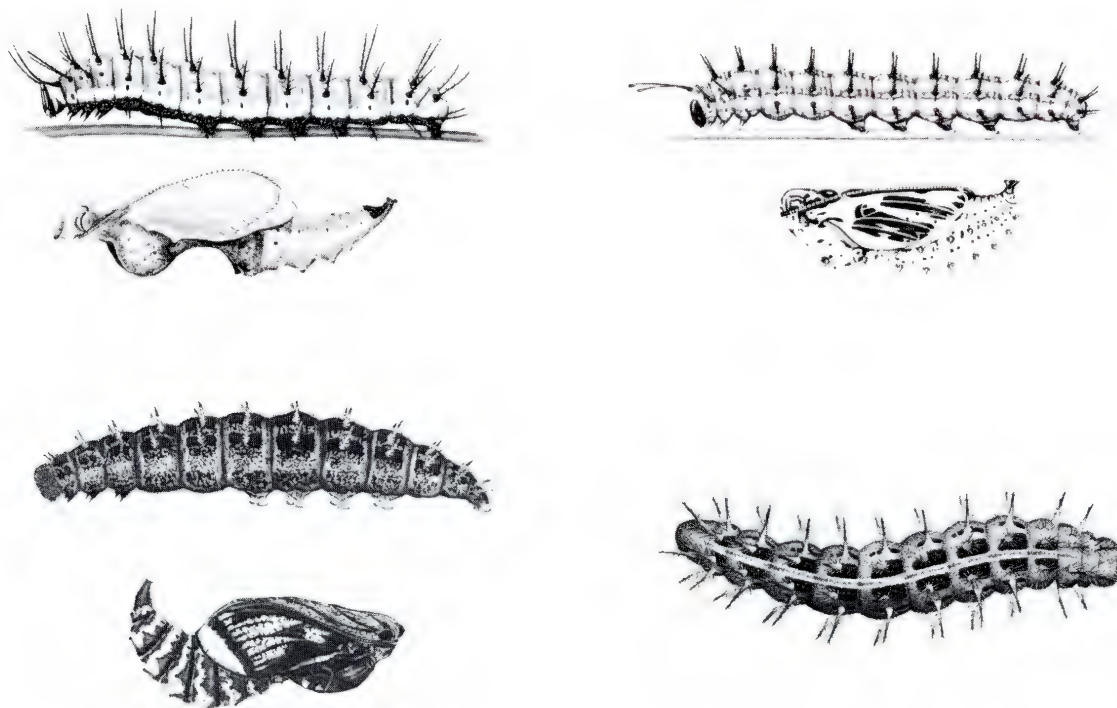


FIGURE 26. Mature larvae and pupae: *Agraulis vanillae incarnata*—upper left, *Euptoieta claudia*—upper right; *Speyeria callippe comstocki*—lower left; *S. c. macaria*—lower right. (Paintings by C. M. Dammers.)

large population of *Euptoieta* adults in the New York Mountains. About a month later, Dammers went out to the area to look for immatures and found the foodplant to be a tiny plant which he could not identify. The likely foodplant for this and other seemingly transient populations in our area would be this *Linum* species.

Foodplants: *Passiflora* (Passifloraceae), *Linum* (Linaceae), *Viola* (Violaceae), and other species are used elsewhere and the search for resident breeding populations should center on these prospective hosts.

Early stages (text fig. 26): The cone-shaped egg is pale green. The mature larva is largely reddish yellow, with two brown lateral bands, a series of white dorsal spots, and six rows of black spines. The pupa is quite different from that of *Agraulis* and resembles a checkerspot (e.g., *Euphydryas*) pupa. It is pearly white with black spots and streaks.

THE LESSER UNSILVERED FRITILLARY *Speyeria adiastrae* (Edwards)

There are two subspecies of this fritillary in southern California:

(a) THE UNSILVERED FRITILLARY *Speyeria adiastrae atossa* (Edwards)

Plate 3, figures 29, 30

One of the rarest fritillaries in collections, *Speyeria adiastrae atossa* has been avidly sought by lepidopterists since the time of its original description in 1890. It is a large pale race of the northern California species *adiastrae*, with light creamy buff undersides and pale buff spots in place of the silver spots of the usual fritillary hindwing. An extremely rare silvered variety of *S. adiastrae atossa*, named form "tejonica" by Comstock, shows silvering on the usual spots of the ventral surface. Comstock (1927a) estimated its occurrence as one specimen in every five or six hundred of regular *atossa*.

The last known specimens of *atossa* were taken in 1959: one south of the town of Tehachapi by an amateur collector (this specimen is in the Natural History Museum of Los Angeles County) and the other on June 5 by Garth at McGill Public Camp in the Mt. Pinos area. Since then, none to our knowledge has been taken. The butterfly has either become exceedingly local or else extinct, probably the latter. If *atossa* was truly last taken in 1959, it probably became extinct during the very dry years of 1959 to 1961. The year 1961 was the driest ever recorded in southern California and could have provided the fatal blow to already greatly reduced populations. Since the 1920s, overgrazing has probably contributed to the demise of violet foodplants utilized by *atossa*. Comstock took over 500

adults in a single day (11 June 1922) at Liebre Gulch, just below the now defunct resort of Sandberg's on the old Ridge Route in the northwest corner of Los Angeles County. Repeated visits to this area by many southern California lepidopterists have failed to yield a single *atossa* in at least the last 20 to 30 years.

The butterfly's former range included the Tehachapi Mountains (type locality), the Tejon Mountains (Ft. Tejon to Bouquet Canyon), and the Mt. Pinos area. The flight period was principally June and July, although females were taken into early September in some years.

Foodplants: Comstock (1927a) states that *Viola pinetorum* Green was present in fields where *atossa* was emerging; this suspected foodplant is now called *V. purpurea* Kell. ssp. *purpurea* and it still grows in some of the areas where *atossa* used to fly. Another violet, *Viola quercetorum* Baker & Clausen, is found in the known *atossa* localities and may have served as a foodplant. Both wild violets are in the family Violaceae.

Early stages (no text fig.): Unknown in detail.

(b) CLEMENCE'S FRITILLARY *Speyeria adiastrae clemencei* (Comstock)

Plate 3, figure 31

Clemence's Fritillary is geographically and phenotypically intermediate between the dark northern *Speyeria adiastrae adiastrae* Edwards and the very light southern *S. adiastrae atossa*. The male's ground color is a light fulvous, whereas *atossa* is a clear, yellow brown and *adiastrae* a rich, dark fulvous. The ventral coloration and spotting is darker than in *atossa*. *Speyeria adiastrae clemencei* occurs in the Coast Ranges from San Luis Obispo (at the northern edge of our area) north to the Monterey region; the type locality is Atascadero. The butterfly has not been found yet in the distributional gap between the San Luis Obispo *clemencei* area and the Mt. Pinos *atossa* colony site. There may still be "island" populations of *S. adiastrae* to be discovered, perhaps surviving from a wetter time when the species occurred in an unbroken range throughout the coastal mountains.

On Chews Ridge in Monterey County, the species appears in good numbers and adults may be taken on flowers of California Buckeye (*Aesculus californica* (Spach) Nutt.) or on thistles and other composites. Mori and Swisher have taken it in numbers from mid to late June approximately 15 mi E San Luis Obispo and 5 mi S Pozo, below the Hi Mountain lookout station. The normal flight period throughout the range of this subspecies is mid-June to August, with males emerging first.

Foodplants: Suspected to be *Viola quercetorum* Baker & Clausen or *V. purpurea* Kell. subspecies, but the life history is still unknown.

Early stages (no text fig.): Unknown.

THE CORONIS FRITILLARY

Speyeria coronis (Behr)

There are three subspecies of this fritillary in southern California:

(a) THE CORONIS FRITILLARY

Speyeria coronis coronis (Behr)

Not figured

This large, dark fritillary occurs in the Coast Ranges from the San Luis Obispo and Atascadero region north. It should be particularly sought wherever *S. adiaspe clemencei* occurs. The flight period is late June to August. Lane has taken specimens near San Marcos Pass in Santa Barbara County which appear to be the Coronis Fritillary.

Foodplants: Unknown.

Early stages (no text fig.): Unknown.

(b) HENNE'S FRITILLARY

Speyeria coronis hennei (Gunder)

Plate 3, figure 36

Plate 4, figure 1

This larger, lighter brown race of *Speyeria coronis* occurs in the Mt. Pinos region of Ventura County, the Tehachapi Mountains, and perhaps also in the Piute Mountains area of Kern County. It is a scarce butterfly and difficult to capture. The best known populations are in the hills behind Chuchupate Ranger Station southwest of Frazier Park (Ventura County), the summit area of Mt. Pinos, and along the fire road up Double Mountain (at 6000 ft.) in the Tehachapis. No blend zone of the brown subspecies *hennei* and the reddish southern *semiramis* is known. The flight period is late June to early August.

Foodplants: Unknown.

Early stages (no text fig.): Unknown.

(c) THE SEMIRAMIS FRITILLARY

Speyeria coronis semiramis (Edwards)

Plate 3, figure 32

This beautiful fritillary sports a rich ruddy glow on its dorsal surface and a darkish, intensely silvered underside. It is reasonably abundant at times and ranges through the San Gabriel, San Bernardino, San Jacinto, Santa Ana, Palomar and Laguna mountains, usually in the Ponderosa Pine-bordered meadows of the Transition Zone. One female was collected by Langston in Box Canyon at Anza Desert in San Diego County (August 25), an eastern record. Southernmost of the three races of *Speyeria coronis* in our area, the Semiramis Fritillary is

frequently found feeding on blooming thistles and flies from late June to September. Specimens from San Diego County tend to be smaller than those from the San Gabriel Mountains.

Foodplants: Unknown

Early stages (no text fig.): Unknown. The life history could be easily worked out by an enterprising lepidopterist.

THE GREENHORN FRITILLARY

Speyeria hydaspe viridicornis (Comstock)

Plate 3, figures 34, 35

Found only in the Greenhorn Mountains of Kern County, *Speyeria hydaspe viridicornis* is the southernmost representative of a Sierran and Rocky Mountain species. The roads around Greenhorn Mountain Park and Shirley Meadows are the sole places it has been taken. The flight period is the end of June to the first part of August.

Foodplant: The host is strongly suspected to be *Viola sheltonii* Torr. (Violaceae) which grows at Shirley Meadows where *S. h. viridicornis* has been taken in good numbers.

Early stages (no text fig.): Unknown.

THE CALLIPPE FRITILLARY

Speyeria callippe (Boisduval)

Two subspecies of this species occur in southern California:

(a) COMSTOCK'S FRITILLARY

Speyeria callippe comstocki (Gunder)

Plate 4, figures 2, 3

This light colored, tannish brown fritillary occurs in the Coast Ranges from Monterey County, where it meets the north-central California typical race, *S. callippe callippe*, south to San Diego County. In the Sierra Madre Mountains of Santa Barbara County, *S. c. comstocki* probably blends with *S. c. macaria*. The type locality of *S. c. comstocki* is Griffith Park in Los Angeles, where specimens used to be relatively common in late May and June during the first three or four decades of this century. Gunder (1930) described the favorite collecting site of those days thusly: "A short dirt road leads from the back of the City Nursery to the top of the hills in Griffith Park. By hunting near here at the proper time, many specimens may be taken."

The butterfly still occurs abundantly on the 4500 ft ridge southwest of Santiago Peak in the Santa Ana Mountains of Orange County and throughout the foothills and mountains of San Diego County. It is found less commonly on other grassy mountain slopes south and north of the Los Angeles basin, such as near Malibu Lake in the Santa Monica Mountains and at Barley Flats in the

San Gabriel Mountains. Langston has also taken this subspecies on Santa Cruz Island (along the ridge south of Chinese Harbor). It flies in late May to July. Comstock (1927a) aptly captures the thrill of seeing this early-flying *Speyeria* in its chosen habitat:

"When the grassy foothills have changed their verdant spring garb for the tan of late May and June, this spangled beauty comes forth, to flaunt its lustrous wings in the bright sunlight. Always it seeks the haunts where, earlier in the season, the yellow violets peeked at one another. One may not recognize their withered leaves, but instinctively the female *callippe* knows that in the coming year her progeny will find them, and places her eggs accordingly."

Foodplants: *Viola pedunculata* T. & G. (Violaceae); probably also uses *V. quercetorum* Baker & Clausen.

Early stages (text fig. 26): The yellowish egg is barrel-shaped with a sloping top and many vertical and cross ribs. The mature larva is blackish brown with light speckles and bears six rows of branching, whitish spines. The pupa is dark brown with lighter markings as shown in the figure.

(b) THE MACARIA FRITILLARY

Speyeria callippe macaria (Edwards)

Plate 4, figures 4-6

Occurring in a belt of central mountain ranges away from the coast, this race is characterized by a light ground color dorsally and a very light yellow-buff ventral surface bearing moderately-sized, brilliant silver spots. A ventral reddish suffusion occurs towards the base of the forewings. Once thought by many collectors to be rare, it actually becomes abundant at times in its favored habitats. *Speyeria callippe macaria* is found from the Mt. Pinos region through the Tehachapi Mountains to the Bouquet Canyon area and northeast to the Greenhorn and Piute mountains at the southern end of the Sierra Nevada range. It flies from late May to July and emerges earlier than other *Speyeria* species occurring in the same locality. The adults are often very abundant on the flowers of *Eriodictyon* and *Aesculus californica*. They also hilltop frequently.

Throughout the range of *macaria* can be found an unsilvered form which was named "laurina" by Wright. In the northern one-fourth of the subspecies' range, the populations are predominantly this form, and through the remaining area there is a gradual increase in silvering until one reaches completely silvered populations at Sandberg's and Bouquet Canyon (Sette, 1962). At the latter localities, there is historical evidence (Gunder, 1930)

that unsilvered "laurina" have occurred there in the past in low frequencies.

Foodplant: Probably *Viola quercetorum* Baker & Clausen.

Early stages (text fig. 26): The egg is sub-conoidal in form, with approximately 30 longitudinal ridges and small transverse partitions connecting these. The color is pale straw. The mature larva is velvety black with branching spines. The black background is broken up by gray spots and bands. The pupa is dirty ivory, heavily overlaid with black markings.

THE TEHACHAPI FRITILLARY

Speyeria egleis tehachapina (Comstock)

Plate 4 figures 7, 8

One of the rarest butterflies in North America, this lightly marked, almost unsilvered race was long known only from the four type specimens, collected in mid-July 1918, in the Tehachapi Mountains. Since then, several collectors have been fortunate enough to obtain more examples in the type locality and surrounding areas, and a brief account of the butterfly's ecology has been published (Emmel & Emmel, 1963a).

The Tehachapi Fritillary is now known to occur on several of the higher peaks of the Tehachapi Mountains, including the ridge running east of the 7986 ft northern peak (called Mt. Tehachapi) of this range. It has also recently been taken on the summit of Piute Peak by Jim Brock of Bakersfield. Hence, the butterfly will probably be found on some of the peaks of the extreme southern Sierra Nevada (e.g., Owen's Peak, 8475 ft) and possibly on some higher peaks of the Greenhorn Mountains. The recently discovered population on Piute Peak is the most accessible known colony because of the road to the top. Males hilltop in erratic, rapid flight along mountain ridges while females flutter about in the grassy slopes and clearings along the sides of such high ridges. The flight period is July and very early August.

Collectors who believe they have captured *S. e. tehachapina* should carefully compare their specimens with *S. callippe macaria* form "laurina". The two butterflies are rather easily confused, but *S. e. tehachapina* is darker and more uniformly tannish brown on the ventral surface. Careful comparison of the colored plate figures should remove any confusion.

Foodplant: Strongly suspected to be *Viola purpurea* Kell. ssp. *xerophyta* Baker & Clausen. This plant is locally abundant on the peaks in the Tehachapi Mountains where *tehachapina* flies.

Early stages (no text fig.): Unknown.

THE WESTERN MEADOW FRITILLARY

Boloria epithore sierra Perkins

Plate 4, figures 9, 10

This small, ruddy fritillary is found throughout the Sierras and into northern California. In our region, it is found only in one isolated area at the extreme northern end of the Greenhorn Mountains, Kern County, around Tiger Flat Campground. The butterfly prefers cool, moist wooded areas and hence reaches the southward limit of its range in the northern Greenhorns. The flight period is June to early July. Colonies of the probable foodplant, *Viola glabella*, are found in several other areas in the Greenhorn range, and thus the butterfly should be sought in these localities: along Sandy Creek on the west slope of Sunday Peak, and at Little Poso Creek just below Pettit Meadow. Perkins and Perkins (1966) mention that the Greenhorn Mountains population is reasonably distinctive in phenotype from the northern coastal subspecies of *Boloria epithore*, and Perkins (in Perkins & Meyer, 1973) named all the Sierran populations *B. e. sierra*.

Foodplant: Very likely to be *Viola glabella* Nutt. (Violaceae) in the Greenhorns. The southern limits of the plant's range correspond to the butterfly's range, and *B. epithore* is associated with this *Viola* in Mendocino County in California.

Early stages (no text fig.): Unknown.

THE CHALCEDON CHECKERSPOT

Euphydryas chalcedona (Doubleday)

This very variable checkerspot occurs over most of southern California, from the chaparral-covered coastal hills and canyons to the desert mountain ranges. The butterfly breaks down into four major subspecific groupings of populations in southern California:

(a) THE CHALCEDON CHECKERSPOT

Euphydryas chalcedona chalcedona (Doubleday)

Plate 4, figures 11, 12

This largely black checkerspot with white and red spots occurs throughout cismontane California in chaparral and coastal sage areas, and in southern California it is one of our most abundant butterflies. The flight period is April to June, depending upon elevation; a few populations on the peaks of the Tehachapis fly in July. The subspecies is single brooded. Adults frequently visit flowers of *Eriodictyon*. Overwintering larvae can be taken in large numbers on *Mimulus* and *Scrophularia* in the early spring, when the half-grown larvae first emerge from their winter diapause.

Foodplants: Monkeyflower, *Mimulus aurantiacus* Curt. and *Scrophularia californica* Cham. & Schlecht (Scrophulariaceae) seem to be the most commonly used foodplants. At one or more locations in California, the larvae of this subspecies

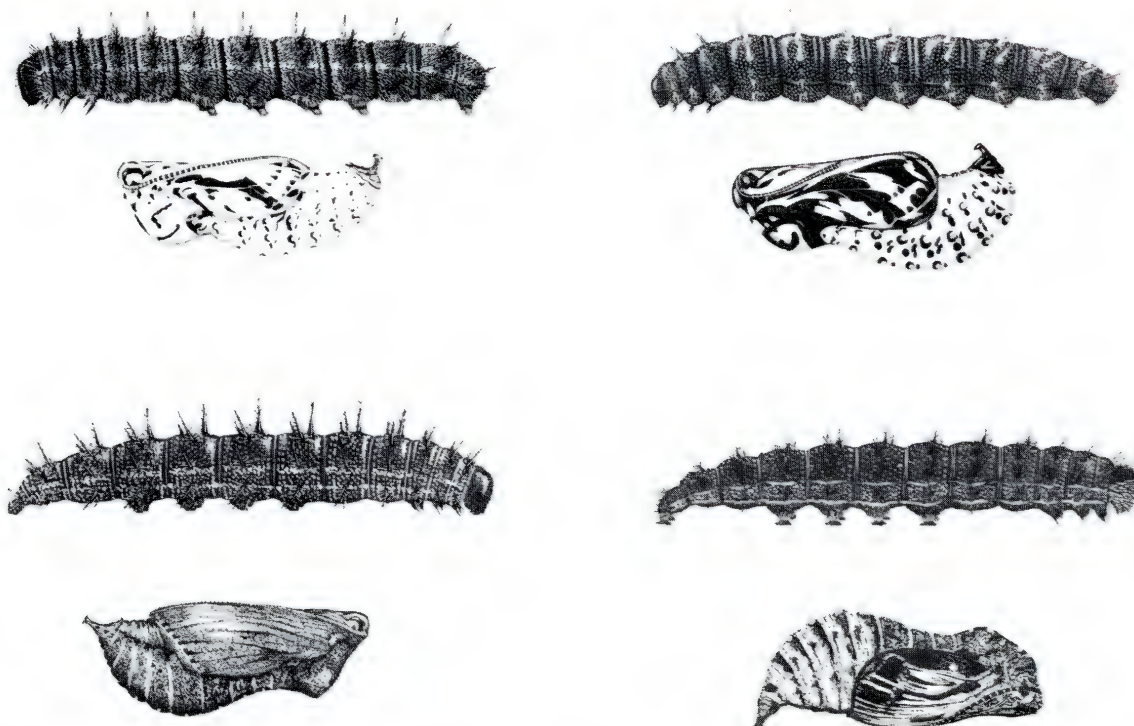


FIGURE 27. Mature larvae and pupae: *Euphydryas c. chalcedona*—upper left; *E. editha wrighti*—upper right; *Chlosyne neumoegeni*—lower left; *C. gabbii*—lower right. (Paintings by C. M. Dammers.)

feed on *Collinsia* and *Castilleja* spp. (Scrophulariaceae), *Plantago erecta* Morris and *P. lanceolata* L. (Plantaginaceae), *Lonicera* spp. (Caprifoliaceae), and *Plectritis* (Valerianaceae). The butterfly uses *Penstemon antirrhinoides* Benth. (Scrophulariaceae) throughout the chaparral areas of Orange County, western San Diego County, and western Riverside County. In the Santa Monica Mountains, Henne has found larvae on *Trichostema lanatum* Benth. (Labiatae!), an unusual foodplant for this nymphalid to use.

Early stages (text fig. 27): The truncated egg is lemon yellow when first laid, changing to red and then black before hatching. The mature larva is black with long branching spines and a whitish dorsal and lateral banding pattern which varies considerably in different populations. The entire body surface bears small white tubercles with short white hairs. The pupa is gray and pearly white, with raised orange spots on the abdomen and black markings as shown in the figure.

(b) THE QUINO CHECKERSPOT

Euphydryas chalcedona quino (Behr)

Plate 4, figures 13, 18

The Quino Checkerspot has been the subject of much confusion in the literature, primarily because three sets of populations have been going under the name *quino*. First, it has been confused with *Euphydryas editha wrighti* which occurs in the inland hills of Orange and San Diego counties and feeds on *Plantago*; this error was even made by Comstock (1927a) and in life history paintings and subsequent publications.

Also, the strongly reddish *chalcedona* subspecies at Whitewater Canyon and elsewhere along the desert base of the San Jacinto Mountains, often called "*quino*" even by Gunder (1929), is a different butterfly than the *quino* originally described from San Diego County. *Euphydryas chalcedona quino* is a generally smaller checkerspot with more pronounced white markings and less red coloration than those from the Whitewater area but more red than *E. c. chalcedona* shows. It occurs along the western edge of the Colorado Desert in San Diego and Riverside Counties, and is generally found at the lower edge of the chaparral or in desert canyons. Males frequently "patrol" canyon washes. The flight period is March to April. A fall brood can be taken if summer rains are favorable for the renewed growth of the foodplant.

Foodplant: *Penstemon antirrhinoides* Benth. ssp. *microphyllus* (Gray) Keck (Scrophulariaceae).

Early stages (no text fig.): The egg, larva and pupa are generally similar to those of *E. chalcedona chalcedona*, but tend to be smaller. Larvae can

be taken in good numbers in February and March on the *Penstemon* bushes if winter rains have been favorable.

(c) THE DESERT MOUNTAIN CHECKERSPOT

Euphydryas chalcedona kingstonensis Emmel & Emmel

Plate 4, figures 14, 15

This desert checkerspot has gone under the subspecific name *hermosa* Wright for many years, but it is not identical with true, rich orangeish *hermosa* from montane Arizona and southern Utah. *Euphydryas chalcedona kingstonensis* is immediately distinguished by its brown dorsal surfaces with black checks and the tannish brown ventral surface marked with white spots on the hindwings. It flies in the Kingston Range (type locality), and populations with a similar phenotype occur in the Old Woman and Granite mountains north of Amboy, Providence, New York, and Clark mountains, all in the eastern Mojave Desert. The flight period is April, sometimes beginning in late March in years with an early spring. A fall brood sometimes appears after summer rains. The subspecies diapauses as half-grown larvae. Populations of *Euphydryas chalcedona* in the Little San Bernardino Mountains seem to be intermediate between this subspecies and *corralensis* (see following section). Like other desert *chalcedona*, the males often regularly "patrol" canyon washes. This subspecies and the next subspecies are more fully described in Emmel & Emmel (1973).

Foodplant: *Penstemon antirrhinoides* Benth. ssp. *microphyllus* (Gray) Keck (Scrophulariaceae).

Early stages (no text fig.): Refer to other subspecies accounts.

(d) THE ROCK CORRAL CHECKERSPOT

Euphydryas chalcedona corralensis Emmel & Emmel

Plate 4, figures 16, 17

This strongly reddish *Euphydryas chalcedona* race has long been known from a series of populations in desert canyons around the northeastern and eastern ends of the San Bernardino Mountains. Huge populations inhabit the canyons in the Rock Corral area (type locality), where the foodplant is abundant. The males typically "patrol" the washes, searching for females. It blends with typical *E. c. chalcedona* populations to the west and south. The flight period is March and April. In years of heavy summer rains, a fall brood would not be surprising.

Foodplant: *Penstemon antirrhinoides* Benth. ssp. *microphyllus* (Gray) Keck (Scrophulariaceae).

Early stages (no text fig.): Refer to other subspecies accounts.

THE EDITHA CHECKERSPOT

Euphydryas editha (Boisduval)

As with the preceding checkerspot species, *Euphydryas editha* has diverged phenotypically into at least four major geographical sets of populations:

(a) THE EDITHA CHECKERSPOT

Euphydryas editha editha (Boisduval)

Plate 4, figures 19, 20

The typical subspecies, with large and clear yellow spots, was described in 1852 from the mountains of the area now known as Kern County. Today the butterfly is known from only several locations in those mountains. It flies in late April to early June in the Piute Mountains and on Walker Pass (5250 ft).

Foodplant: Probably *Collinsia callosa* Parish or other *Collinsia* species (Scrophulariaceae). Comstock (1927a) lists Edwards' host records for *E. editha bayensis* as hosts for *E. e. editha*, and these are erroneous even for *bayensis*.

Early stages: Unknown to date.

(b) THE COASTAL CHECKERSPOT

Euphydryas editha near *bayensis* Sternitzky

Plate 4, figures 23, 28

In the hills bordering San Francisco Bay, this small, boldly checked subspecies of *Euphydryas editha* is quite abundant each spring. South of that region, widely scattered populations occur along the coastal hills of California. Populations are known from San Luis Obispo County (e.g., 7 mi. W Pozo, in mid-June), the coastal area of Santa Barbara County, and just north of Malibu in Los Angeles County. Populations are also known from the Channel Islands; these are darker than typical *bayensis* and probably represent a distinct but unnamed subspecies. The flight period of all coastal populations is March to April.

Foodplant: *Plantago erecta* Morris (Plantaginaceae) on the sand hills near Santa Maria, the San Francisco Bay Area, and probably at the coastal localities given above.

Early stages: The truncated egg is yellow. The mature larva is black with 7 rows of branching spines (the middorsal and occasionally the laterodorsal rows are orange, while the others are black). Orange spots occur at the bases of the spines in the second lateral row. The pupa is a dull white, marked with bold black blotches and streaks. Each segment bears a transverse row of orange spots.

(c) THE AUGUST CHECKERSPOT

Euphydryas editha augusta (Edwards)

Plate 4, figures 21, 22

Found only in the yellow pine forests of the San Bernardino Mountains, this quite small and rare

subspecies has expanded yellow and red spots, giving it a lighter appearance than the preceding two races. It has been found above 8000 ft on Sugarloaf Peak and along forest roads and meadows at about 5000 ft near Running Springs, Moonridge, Cedarpines Park, Wild Horse Creek, and Fawnskin. It flies in late May and early June.

Foodplant: *Collinsia childii* Parry ex Gray (Scrophulariaceae) at Cedarpines Park. Sala (*in litt.*) reports that it also uses a *Castilleja* species.

Early stages: Undescribed, although reared by several lepidopterists.

(d) WRIGHT'S EUPHYDRYAS

Euphydryas editha wrighti Gunder

Plate 4, figures 24, 25

As noted under *Euphydryas chalcedona quino*, the identification of this butterfly has been somewhat confused in various publications. True *E. editha wrighti* is a large, reddish checkerspot with the characteristic "rounded" forewings of *editha* rather than the more pointed forewings of *chalcedona*. It occurs in scattered colonies on hills and mesas near the coast in San Diego, Orange, and western Riverside (Highway 71 near Elsinore and Gavilan Hills) counties. In most areas it is not a common insect, partly due to urban expansion through much of its former habitat. Populations in the San Diego area in particular are being rapidly exterminated by housing developments, and Fred Thorne states that the subspecies is approaching extinction. The Orange County populations (hills above Hidden Ranch, Black Star Canyon in the Santa Ana Mountains) are perhaps the last real strongholds left, although none have been taken in recent years at Orange County Park where it was formerly common. The flight period is February in some years, but usually entails early March to early April.

Foodplant: *Plantago erecta* Morris (Plantaginaceae).

Early stages (text fig. 27): Similar to *E. e. bayensis*. The species diapauses from April to December as half-grown larvae.

NEUMOEGEN'S CHECKERSPOT

Chlosyne neumoegeni (Skinner)

Plate 4, figures 26, 27, 33

This orange checkerspot is found throughout the desert regions of California, from the foothills of the White Mountains and Inyo Mountains east of the Sierra Nevada south through the Mojave and Colorado deserts to Baja California. It flies from Little Rock Dam and Palm Springs east to the Nevada and Arizona borders. It usually delights in rocky places, especially desert canyons and washes. The lustrous, pearly white spots of the underside are characteristic.

One of the commoner spring butterflies on our northern deserts, *Chlosyne neumoegeni* can be taken in large numbers from late March to April. It is rarer in San Diego County. Despite the mention of a September brood by Comstock (1927a), we have no records of fall brood specimens. The foodplant, Mojave Aster, is a colorful plant when in full bloom and is easy to spot in the desert canyons. Perfect adult specimens may be easily reared from the larvae found on these lavender-flowered asters. The species diapauses as half-grown larvae.

Foodplant: Mojave Aster, *Machaeranthera tortifolia* (Gray) Cronq. & Keck (Compositae), is the main foodplant. Henne has found larvae on *Acamptopappus sphaerocephalus* (Harv. & Gray) Gray var. *hirtellus* Blake (Compositae) in the Pearblossom area; this is a low desert shrub (common name: "Goldenhead") with small, yellow flower heads and small, alternate, spatulate leaves.

Early stages (text fig. 27): The black mature larva has nine rows of branching jet-black spines and is sprinkled with gray dots. The pupa is also black, profusely mottled with gray.

GABB'S CHECKERSPOT

Chlosyne gabbii gabbii (Behr)

Plate 4, figures 32, 34

Gabb's Checkerspot flies commonly in the foothills and canyons of the coastal mountains of central and southern California, from San Luis Obispo to Baja California in our area. Colonies used to occur in abundance on sand dunes near the coast, but most of these populations have been exterminated by housing developments. A small population still persists on dunes at the west end of the Los Angeles International Airport. The species may be taken more commonly in the canyons surrounding the Los Angeles basin or in the Laguna Mountains, San Diego County. It also occurs on Santa Cruz Island and is reported by Langston to be "much more numerous" there than normally observed in mainland populations. The flight season in all these sites extends from late March or April to June and even July at higher elevations. Comstock (1927a) reports an occasional small second brood in the summer.

Foodplants: *Corethrogyne filaginifolia* (H. & A.) Nutt. (Compositae) is regularly used. Henne and Ingham have found larvae feeding in alternate years on *Heterotheca grandiflora* Nutt. and *Corethrogyne* at the same site. Other workers report *Haplopappus squarrosus* H. & A. as an occasional host. All these plants are members of the Compositae.

Early stages (text fig. 27): Described by Comstock (1930). The eggs are laid in masses at the base of the plant. The young larvae are gregarious, but

separate as they approach maturity. The mature larva is black with short black branching spines. There are scattered orange and dirty white markings and spots on either side of a narrow velvety black middorsal line. The ivory ground color of the pupa is nearly obscured by brownish and black blotchings and irrorations. A series of prominent tubercles, each partly colored with light orange, occurs over the dorsal area.

THE NORTHERN CHECKERSPOT

Chlosyne palla (Boisduval)

Distributed from the Rocky Mountains west to British Columbia and our Pacific states, *Chlosyne palla* reaches its southern limit in the northern mountains of our area. It is characteristically a foothill canyon and montane species. Two subspecies are present in southern California:

(a) THE PALLA CHECKERSPOT

Chlosyne palla palla (Boisduval)

Plate 4, figures 29, 30

This subspecies occurs on Mt. Pinos, in the Tehachapi Mountains, the Ridge Route area, and the Greenhorn and Piute mountains region. In the Greenhorns and Tehachapis, the butterfly is on the wing from late May to July.

Foodplants: Henne has found larvae on *Chrysothamnus paniculatus* (Gray) Hall in the drainage of the South Fork of the Kern River in the southern Sierra Nevada. The larvae are also recorded on *Solidago californica* Nutt. in the Inner Coast Range of Stanislaus County, and on *Erigeron speciosus* (Lindl.) DC. in Colorado. The foodplants in the Tehachapi Mountains remain to be discovered, but the recording of *Castilleja* (Scrophulariaceae) as a foodplant of *palla* by Mead in the Wheeler Survey expedition is almost certainly erroneous as all subsequently recorded foodplants have been in the family Compositae. Mead's larval (and foodplant) descriptions match those of *Chlosyne leanira* more than *C. palla*.

Early stages (no text fig.): The mature larva is dull black, with five rows of branching spines. The pupa is light brown with pale brown spots and streaks. Each pupal segment, except the last, bears a triple row of small shining tubercles.

(b) THE DEATH VALLEY CHECKERSPOT

Chlosyne palla vallismortis (Johnson)

Plate 4, figure 31

This subspecies was discovered by John Johnson in mid-June, 1935 at 8000 ft at Tuber Canyon Spring in the Panamint Mountains, Death Valley National Monument. It is characterized as being larger than normal *palla*, having more regular rows of lighter orange spots, and having heavy black lines between

these rows, particularly the heavy black medial band of the dorsal forewing surface. Since its discovery, additional specimens have been taken in upper Tuber Canyon, Baldy Peak, and Telescope Peak in the Panamints, all in mid-June.

Nothing is known of the foodplants or life history of this subspecies.

THE LEANIRA CHECKERSPOT

Chlosyne leanira (Felder & Felder)

This highly variable butterfly occurs in scattered areas throughout the western United States. The *leanira* complex is currently under study by several workers, and a revised classification will be forthcoming. Four general phenotypes are represented by populations in southern California.

(a) WRIGHT'S CHECKERSPOT

Chlosyne leanira wrightii (Edwards)

Plate 4, figures 36, 37

This dark, red and white patched form is the most widespread subspecies of *C. leanira* in our area. It occurs in a spotty distribution in chaparral areas of cismontane southern California (e.g., Mint Canyon, Los Angeles County, and Irvine Park and Silverado Canyon, Orange County) and along the western edge of the deserts. Populations at the desert boundary have a high percentage of adults with the orange-flushed "cerrita" phenotype (see following subspecies). For reasons still obscure, this butterfly in all its subspecies goes through long term numerical fluctuations of major degree. This particular subspecies was abundant in the early part of this century, became scarce for 20-30 years, and recently has become more abundant again. The flight period is April to June.

Foodplants: *Castilleja* species (Scrophulariaceae). Along the desert edge, *C. foliolosa* H. & A. and *C. chromosa* A. Nels. are both used.

Early stages (text fig. 28): The mature larva is black with seven rows of black spines and pairs of orangeish stripes on the sides and top. The white pupa is marked with two prominent black bands on each side, and one ventrally.

(b) THE CERRITA CHECKERSPOT

Chlosyne leanira cerrita (Wright)

Plate 4, figure 38

This butterfly, heavily suffused with brick red, intergrades with typical *wrightii* as a "form" in *Chlosyne leanira* populations along the southwestern edge of the Mojave Desert but is here treated as a subspecies because of its distribution in "pure" populations across the desert. The Cerrita Checkerspot is found in the higher mountain ranges of the Mojave Desert and the lower east slope of the southern Sierra Nevada. Gorelick reports it as "common

during May" in the Ord Mountains and the hills of the outskirts of Hesperia in San Bernardino County. The flight period is April to early May. This subspecies does not seem as widespread as it was reported to be 30 to 40 years ago in the eastern mountains of the Mojave Desert.

Foodplant: *Castilleja chromosa* A. Nels. (Scrophulariaceae).

Early stages (no text fig.): See preceding subspecies. The conspicuous black, spiny larvae can be found on the colorful paintbrush (*Castilleja*) flowers in March and April.

(c) *Chlosyne leanira* near *alma* (Strecker)

Plate 4, figures 39, 40

In Death Valley occur the southwesternmost populations representative of the totally orange-washed *alma* subspecies, found principally to the east in the Great Basin of Nevada and Utah. Langston has taken *C. l.* near *alma* at Aguerberry Camp (5320 ft) and in Wildrose Canyon in the Panamint Mountains in early to mid-April. Other lepidopterists have taken it at scattered sites through Death Valley National Monument. It feeds on the same *Castilleja chromosa* foodplant as *C. l. wrightii*, but the life history is undescribed.

(d) DAVIES' CHECKERSPOT

Chlosyne leanira daviesi (Wind)

Plate 4, figure 35

This butterfly is intermediate in both geography and coloration between *Chlosyne leanira leanira* in northern California and *C. l. wrightii*. It was described from specimens collected by Davies and Wind at Strawberry Lake in Tuolumne County. In our area it is found in rare scattered populations in the coast ranges from San Luis Obispo to Santa Barbara counties. Wind (1947) outlines the differences between the three coastal *leanira* subspecies: "*Leanira* has both fore and hind wings of a dark black brown aspect, while *wrightii* [sic] has considerable orange russett on both fore and hind wings. *Daviesi* can be distinguished easily from these two ... by the bright orange russett fore wings and the very dark black brown hind wings."

Foodplant: *Castilleja foliolosa* H. & A., and *C. affinis* H. & A. are both known foodplants.

Early stages (no text fig.): Unrecorded.

THE BORDERED PATCH

Chlosyne lacinia crocale (Edwards)

Plate 4, figures 41-43

The Bordered Patch is an extraordinarily polymorphic butterfly occurring from southeastern California through the Southwest and Mexico to South America. In our state it occurs principally in cultivated areas in the Imperial and Colorado River

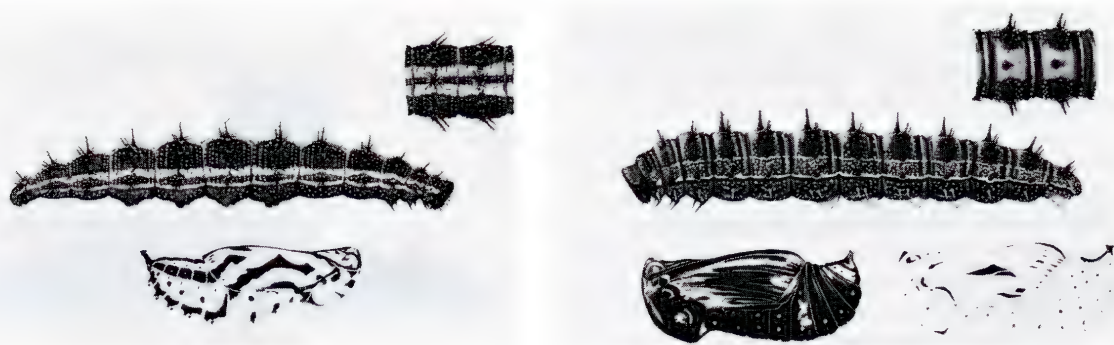


FIGURE 28. Mature larvae and pupae (inserts, dorsal pattern of larvae): *Chlosyne leanira wrightii*—left; *C. lacinia crocale*—right. (Paintings by C. M. Dammers.)

valleys. Strays are taken along the western edge of the Colorado Desert, as on Monument Peak in the Laguna Mountains, San Diego County and at Pin-yon Flat above Palm Springs. Besides the numerous color forms present in the adult and pupal stages, the last three larval instars exhibit a striking color polymorphism with three basic forms: an almost entirely black form (“nigra”), a black form with a prominent middorsal light yellow to orange-red stripe (“bicolor”), and an all orange to orange-red morph (“rufa”). The somewhat complicated genetics of this interesting situation have been worked out thoroughly by Neck, Bush, and Drummond (1971); this paper also illustrates the three morphs in color, and the interested reader is referred to this source for details. The different larval morphs appear to be differentially subject to natural selection by such agents as parasites and birds. The genetics and adaptive significance of the various morphs in the adults and pupae are completely unknown.

The flight period extends from March through October in a series of broods, with the adults considerably more common in the fall months. Overwintering is accomplished in the half-grown larval stage (late third instar or early fourth instar). Borders of agricultural fields with sunflowers are the favored habitat. The species is extremely abundant around Blythe in September.

Foodplants: Sunflower, *Helianthus annuus* L. ssp. *lenticularis* (Dougl.) Ckll. (family Compositae), is the usual host throughout the species' range in the Southwest. Thorne (1962) reported several *C. lacinia* larvae among a colony of *C. californica* larvae on *Viguiera deltoidea* Gray var. *parishii* (Greene) Vasey & Rose in Sentenac Canyon 10 mi NE Julian, San Diego County, in September 1961.

Early stages (text fig. 28): Described in great detail by Drummond, Bush, and Emmel (1970), including laboratory rearing techniques for genetic

studies. Up to 500 eggs may be deposited in several clusters by a female on the underside of a sunflower leaf. The egg is pale greenish yellow. The mature larvae bear seven rows of branched spines and may be basically black, orange, or black with an orange dorsal stripe (illustrated in figure). The pupa varies from almost pure white to almost completely black; two examples of pupal morphs are shown in the figures. Under hot field conditions around Blythe in the late summer and fall, a complete generation can pass in about 30 days.

THE CALIFORNIA PATCH

Chlosyne californica (Wright)

Plate 4, figures 44, 45

The California Patch occurs in the Colorado and Mojave deserts, generally in canyons and washes. It is particularly abundant in the canyons near Palm Springs, such as Whitewater Canyon and Chino Canyon, but also regularly occurs in numbers in Gilroy and Bonanza King Mine canyons in the Providence Mountains, the Big Horn Mountains, the Sheephole Mountains, Joshua Tree National Monument, and the western desert areas in San Diego County, especially Sentenac Canyon at Anza Desert. An altitude record for a non-desert area is Monument Peak in the Laguna Mountains of San Diego County (late May, by Langston). Several broods normally appear, depending upon the timing of our rainfall. The spring brood flies in March and April. Smaller broods emerge in June and September to November. Appearance and abundance is correlated with rainfall, as with most desert butterflies.

Foodplant: *Viguiera deltoidea* Gray var. *parishii* (Greene) Vasey & Rose (family Compositae).

Early stages (text fig. 29): The egg is pale yellowish green. In Chino Canyon populations, the mature larva is usually black (illustrated in figure) with seven rows of black branched spines, and vertical rows of white dots along the entire body. However,

the basic "bicolor" and "rufa" morphs present in *C. lacinia* are also found in *C. californica*. The pupa is normally largely white with variable black streaking across both the wing case and abdomen.

THE IMPERIAL CHECKERSPOT

Microtia dymas imperialis Bauer

Plate 4, figures 46, 47

This tiny checkerspot has been burdened with progressively longer names by taxonomists since Comstock's 1927 book on California butterflies (it was then known as *Melitaea chara*). Today our southern California populations are recognized (Bauer, 1958) as a distinctive subspecies, *Microtia dymas imperialis*, of a wider ranging species whose fall-flying populations in Arizona and Sonora (Mexico) are called *M. dymas chara* and whose populations in New Mexico and Texas are known as *M. dymas dymas*.

The Imperial Checkerspot is found throughout the Coachella and Imperial valleys, especially in canyons and washes. The Palm Springs area, Chino Canyon, and Borrego Palm Canyon are particularly well known collecting areas for this species. Extraordinarily, there is an isolated population of *M. d. imperialis* located on the coastal side of the mountains in San Diego County, on a hill about 2 mi N Lakeside. Langston has records from this colony from 1951 to 1965. The butterfly flies here in close association with a colony of foodplant (also completely out of its normal Colorado Desert range) and occurs in two broods: May to June and again in September. On the deserts, the Imperial Checkerspot flies in an earlier spring brood (March to April or sometimes May) and in September to October after summer and fall rains.

Foodplant: Chuparosa, *Beloperone californica* Benth. (family Acanthaceae). The colony of foodplant near Lakeside is considerably out of its known range and perhaps the original seeds or plants were transported to this site on the coastal side of the mountains by Indians or early settlers.

Early stages (no text fig.): The egg is nearly round and light lemon yellow in color. The mature larva is predominantly gray with many short, black, branching spines. The gray is broken up by black and white mottlings, with orange patches at the bases of most of the spines. The pupa is whitish gray, speckled with black and brown.

THE PHAON CRESCENT

Phyciodes phaon (Edwards)

Plate 5, figures 5, 6

Relatively common in the southeastern United States and the Gulf states, the Phaon Crescent reaches its western limits in the extreme southern

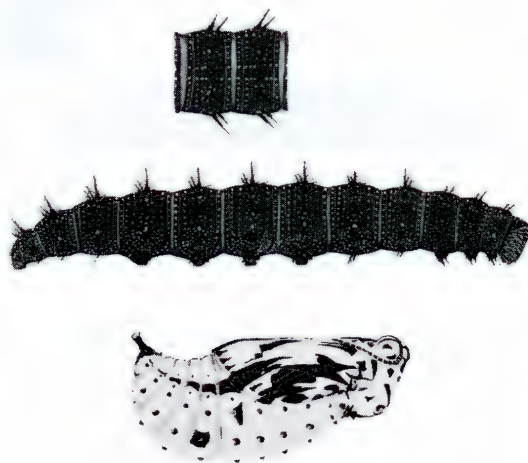


FIGURE 29. Mature larva and pupa (insert, dorsal pattern of larva): *Chlosyne californica*. (Paintings by C. M. Dammers.)

portion of California. It is common in cismontane San Diego County around Lippia lawns and throughout the lowlands of Imperial County. Comstock (1927a) states that it was found up to San Bernardino at that time and perhaps the species was established there on ornamental lawns or gardens of Lippia; no recent records exist. The flight period is March to October, apparently in several broods (there are very few records in September). Two records exist for February.

On the coastal side of the mountains in San Diego County, Langston reports two isolated but large colonies: Gillespie Field near Santee, and at Lindo Lake near Lakeside. Both may be exterminated by an expanding airport and extensive subdivision development. Lane has taken this species near Rancho Sante Fe in lowland San Diego County (18 February 1967).

Foodplants: *Lippia lanceolata* Michx. and *L. nodiflora* Michx. var. *rosea* (D. Don) Munz. (family Verbenaceae). The common names of these plants are Fog Fruit and Mat Grass, respectively, or often merely "Lippia."

Early stages (text fig. 30): The mature larva is basically olive in color, with a longitudinal, dark brown band high on each side and a whitish scalloped lateral band below the spiracles. The whitish head has large brown patches on the top and sides. There are nine rows of highly branched spines. The pupa is brownish and heavily speckled with black and white marks.

THE FIELD CRESCENT

Phyciodes campestris campestris Behr

Plate 5, figures 1, 2

This widely distributed western *Phyciodes* is generally scarce and spotty in the mountains of southern California, perhaps because of the paucity of its favored wet meadow habitats. It is also a lowland species in northern California, but seems to be rare south of Monterey and San Benito counties. It may be found in meadows in the San Bernardino and San Jacinto mountains (e.g., Idyllwild) with fair regularity; in San Diego County, it is reported to be a rare capture. The Field Crescent is multiple brooded at lower elevations, and single or double brooded in the mountains. Our records extend from April to the first week of September.

Foodplants: *Aster hesperius* Gray (Compositae), which occurs along stream banks and marshy meadows up to 5500 ft elevation in cismontane southern California. Other *Aster* species are undoubtedly used at the higher elevations.

Early stages (text fig. 30): Described by Comstock (1929). The eggs are laid in a cluster on the foodplant. The mature larva is basically black, with numerous branching spines. There is a dorsolateral grayish white band. Below the spiracles runs a mottled yellowish brown band. The abdominal surface is brown. The pupa is soft wood brown, with a network of darker brown lines and irroration.

THE PEARL CRESCENT

Phyciodes tharos (Drury) near *pulchella* (Boisduval)

Plate 5, figures 3, 4

The Pearl Crescent flies abundantly from Canada through the eastern half of the United States to Mexico. In Colorado, it stops abruptly at the Rocky Mountains and is replaced by *Phyciodes campestris* in its favored meadow habitats. But to the south it seems to have moved through New Mexico and Arizona or northern Mexico to our southeastern California area. In the 1930s, Gunder noted this species as occurring in the Imperial Valley and

being phenotypically different from typical *tharos*. Henne has taken them (9 October 1935) from a resident population near the Del Rio Club in Brawley, Imperial County. Other collectors have picked up specimens in vegetation along irrigation ditches in the Brawley area of the Imperial Valley during the late summer and fall months. Before the introduction of irrigation in this arid desert country, it is doubtful that *P. tharos* could have resided in the natural habitats of the area. It should be multiple brooded here, since in similar climatic regimes in the southern states the species has up to five annual broods. The subspecific name closest to our material is *P. tharos pulchella* (Boisduval).

Foodplants: Unknown in California. Elsewhere, *Aster* (Compositae) is used.

Early stages (text fig. 31): The eggs are laid in masses of 20-200 on the leaves of the foodplant. The mature larva is blackish with yellow dots and yellow lateral and near dorsal bands. All the branched spines are yellow-brown. The larvae feed communally. Hibernation occurs as part-grown larvae. The mottled pupa is brown to gray-brown.

THE MYLITTA CRESCENT

Phyciodes mylitta mylitta (Edwards)

Plate 5, figures 7, 8

The Mylitta Crescent is found from British Columbia to Baja California. In southern California, it occurs throughout the moister mountain areas but will also fly in drier habitats than *Phyciodes campestris*. The adults appear in several broods at lower elevations with the spring generation flying from March to May and one or more summer broods becoming more abundant through the summer months until September. In the higher mountain populations only one brood is found, during mid-summer.

Foodplants: Thistles (*Cirsium* species, family Compositae). The particular species used have not been identified in publications on the life history of the species.



FIGURE 30. Mature larvae and pupae: *Phyciodes phaon*—left; *P. campestris*—right. (Paintings by C. M. Dammers.)



FIGURE 31. Adult male, egg, larvae (including details of head and a proleg segment) and pupa: *Phyciodes tharos*. (From Edwards, 1884.)

Early stages (text fig. 32): The whitish egg is truncated with a flat bottom and top. The mature larva is velvety black with a yellowish abdomen. There is a pair of dorsal yellow lines and a pair of similar lines on each side. Pale yellow spots are scattered over the body. Nine rows of branched spines are present; these are black except for those below the spiracles. The pupa is wood brown to ashy gray and may have a golden reflective sheen.

THE SATYR ANGLEWING

Polygonia satyrus satyrus (Edwards)

Plate 5, figures 10, 11

In the mountain ranges of southern California (except for the desert peaks), one can find *Polygonia satyrus* on the wing from as early as February until November. It prefers the moister areas such as canyon bottoms where nettles grow in abundance. It does not seem to be found in San Diego County. The light ground color of the dorsal surface and the mottled brown of the underside distinguish *P. satyrus* from the Zephyr Anglewing. Occasionally, a very light form of the female is taken; the dark markings are almost absent. This uncommon form was named "chrysoptera" by Wright.

The species hibernates in the adult stage and overwintering adults begin flying in February (Langston has a record for the end of January) or March, continuing into April. Progeny from eggs laid by this brood emerge in June, July, and August. There is occasionally a third brood from eggs laid

by individuals emerging in early summer.

Foodplant: Nettle, *Urtica holosericea* Nutt. (Urticaceae).

Early stages (text fig. 33): The delicate green eggs have very elevated vertical ribs; they are often laid in stacks of three or four on the underside of a host plant leaf. The ground color of the mature larva is black, but it is heavily mottled with greenish white as shown in the figure. There is a broad greenish white dorsal stripe. The very heavily branched spines occur in seven rows and are greenish white. The black head is spiny and bears a short branching tubercle at each of the upper corners. The pupa is a shiny gray-brown with several raised golden spots.

The larvae of this anglewing can be easily located by looking for the characteristic changes they make

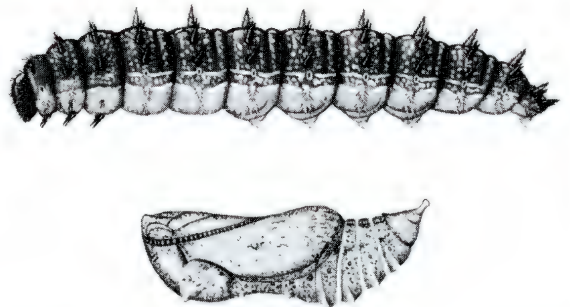


FIGURE 32. Mature larva and pupa: *Phyciodes mylitta*. (Paintings by C. M. Dammers.)

in the appearance of the nettle leaf. The larvae partially sew the proximal edges of a nettle leaf together *beneath* the leaf axis to produce a "hanging tent," in contrast to *Vanessa atalanta* larvae (also nettle feeders) which sew the entire edges of the nettle leaf together and often do this *above* the leaf axis.

THE ZEPHYR ANGLEWING

Polygonia zephyrus (Edwards)

Plate 5, figures 9, 13

The Zephyr Anglewing is found rather uncommonly through the higher elevations of the mountains of southern California, outside the deserts. However, the butterfly may eventually be found in the higher canyons of the Panamints and Clark Mountain, where its foodplant grows. It is also not reported from San Diego County as yet. It is far more abundant to the north in the Sierra Nevada and along the coastal ranges. The mottled gray underside is a distinctive character. Overwintering adults fly from April to June and progeny resulting from their eggs emerge in July and August.

Foodplant: Currants and Gooseberry, *Ribes* species (Saxifragaceae); probably *Ribes cereum* Dougl. and *R. montigenum* McClat. in our area (see larval illustration for outline of typical foodplant leaf).

Early stages (text fig. 34): The mature larva is basically black with a whitish yellow dorsal pattern. The four lateral rows of branching spines are black and the three dorsal rows are partly reddish and partly white. The pupa is shaded with olive and salmon, and has several silver spots in the dorsal region.

THE MOURNING CLOAK

Nymphalis antiopa antiopa (Linnaeus)

Plate 5, figure 12

This familiar, deep brownish butterfly with yellow margins is widespread through southern California



FIGURE 34. Mature larva and pupa: *Polygonia zephyrus*. (From Edwards, 1884.)

outside of the deserts and occurs at all elevations. Its distribution in the Mojave and Colorado desert mountain ranges is spotty and rare, occurrences being limited to canyons where willows grow in a few well-watered sinks. In our cities the larvae often reach pest proportions on elm trees. Overwintering adults can be seen on warm days in the winter months throughout urban and coastal areas. The butterfly is multiple brooded at lower elevations and single or double brooded in higher zones.

Foodplants: Willow, *Salix* species (Salicaceae); Cottonwood and Aspen, *Populus* species (Salicaceae); Chinese elms, *Ulmus* species (Ulmaceae).

Early stages (text fig. 35): The whitish egg is barrel-shaped with a truncated apex. The first-instar larva is whitish with a black head. The familiar mature larva bears seven rows of long thin black spines and is basically black with intensive white spotting. The spiny pupa is gray with lighter wing cases.

THE CALIFORNIA TORTOISE-SHELL

Nymphalis californica californica (Boisduval)

Plate 5, figure 14

The California Tortoise-shell is generally rare in southern California, despite its abundance through-

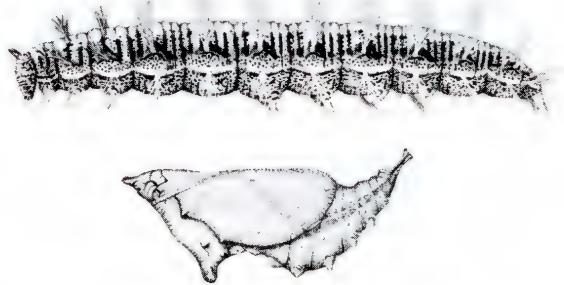


FIGURE 33. Mature larva and pupa: *Polygonia satyrus*. (Paintings by C. M. Dammers.)



FIGURE 35. Mature larvae and pupae: *Nymphalis antiopa*—left; *N. milberti furcillata*—right. (Paintings by C. M. Dammers.)

out most of the West and the abundant presence of its foodplants here. It is found only in the higher mountains, except in years of exceptional numbers in northern California or Pacific Northwest populations. Then vast migratory movements occur, where millions may fly for great distances and for days on end. At such times the adults appear as scattered strays even down to the desert floor in San Diego County. In one such year (1960), several adults were taken at Clark Mountain in the eastern Mojave Desert.

Overwintering adults fly from April to June and progeny from eggs laid by this spring "brood" emerge in July and August.

Foodplants: *Ceanothus* species (Rhamnaceae).

Early stages (text fig. 36): The mature larva is deep velvety black with numerous white dots (each bearing a short whitish hair) accentuating each segmental region. There are seven long branching spines on each segment, all being bluish black except for the yellow dorsal row. The pupa is gray with a bluish sheen; the abdominal region is fawn colored. The head bears two blackish extensions.

MILBERT'S TORTOISE-SHELL

Nymphalis milberti furcillata (Say)

Plate 5, figure 15

Like the California Tortoise-shell, this species is an uncommon find in our region. It flies in the higher elevations of the mountains, generally in wet meadow situations where nettle (*Urtica*) is abundant and grows in full sun. Although adults are rarely taken in southern California, the authors have taken larvae in large numbers in the Tehachapi and San Bernardino Mountains. Fair numbers of adults occur at times in the moist meadows of the Greenhorn Mountains of Kern County. Oakley Shields reports the species is very rare in San Diego County. Adults have been collected in April at Wildrose Springs in the Panamint Mountains of Inyo County, and the species may be established there on a local nettle colony.

Overwintering adults fly from April to June and progeny from these appear in July, August, and September.

Foodplant: Nettle, *Urtica holosericea* Nutt. (Urticaceae).

Early stages (text fig. 35): The conical green egg has a round top and flat base and eight or nine vertical ribs. The mature larva is generally black, covered with white hairy dots, with a greenish yellow lateral line and a higher, bright orange stripe. Five upper rows of branching spines are black while the lowest row on either side is yellowish. The pupa is highly variable in color, from an off white to blackish, and is semi-spiny, somewhat like *N. antiopa*.

THE RED ADMIRAL

Vanessa atalanta rubria (Fruhstorfer)

Plate 5, figure 16

The Red Admiral is widespread in southern California beyond the desert borders, but is also rarely taken in the desert mountain ranges, such as the Providence Mountains. It has been collected by Langston on Santa Cruz Island from April to June. Our butterfly is the North American subspecies of the European *Vanessa atalanta* and ranges from

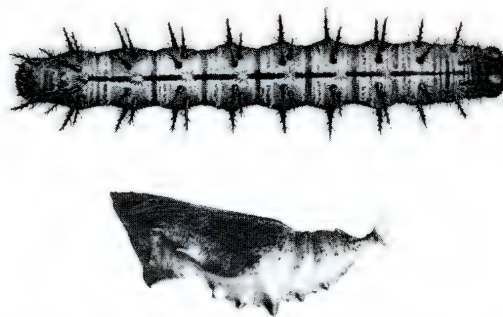


FIGURE 36. Mature larva (painting by C. M. Dammers) and pupa (from Comstock, 1932): *Nymphalis californica*.

Hudson Bay to Guatemala. Overwintering adults occasionally fly in the winter months on warm days, but the general flight period in our area for this multiple brooded species is March to November. Adults have been seen in Los Angeles every month of the year. In the suburbs, males frequently set up "territories" on sunlit driveways and patios which they visit and perch in every afternoon for several weeks on end.

Foodplants: *Urtica holosericea* Nutt. (Urticaceae); perhaps *Parietaria* species (Urticaceae) in the deserts; Hops, *Humulus lupulus* L. (Moraceae), wherever this plant is cultivated. Hogue has found larvae on the widely cultivated ornamental *Soleirolia soleiroliae* (Baby's Tears, family Urticaceae) in urban areas, perhaps explaining the species' abundance there.

Early stages (text fig. 37): The barrel-shaped, highly ribbed egg is a delicate pale green. The mature larva is black and studded with hundreds of whitish velvety points and the usual seven rows of spines (all light colored). Its behavior in drawing the edges of a leaf together to make a tent has been described in the section on *Polygonia satyrus*. The pupa is gray with gilded tubercles.

THE PAINTED LADY

Cynthia cardui (Linnaeus)

Plate 5, figure 19

Perhaps the best known, least variable, and yet most cosmopolitan butterflies in the world, the Painted Lady experienced a generic "name-change" in 1971. *Vanessa cardui* and several of her cohorts (*Vanessa carye* and *V. virginiensis*) were switched from *Vanessa* to *Cynthia* because of several genitalic and tarsal foot differences (compared to *V. atalanta*) which would appear minute indeed to anyone but a taxonomic specialist (Field, 1971). While we use the new name here, it seems from naturally occurring hybrids between *atalanta* and *carye* (= *annabella*) (see following species account for details) that this group of species is genetically closely related.

In southern California, the Painted Lady can be found in all months of the year in the deserts and flies in the spring through the fall in the more coastal and montane sections. There is a resident breeding population on Santa Cruz Island from at least April through the summer months if not all year. In some years, after heavy winter rains in the deserts, *C. cardui* appears in huge numbers on the deserts and migrates northward by the millions in the spring. Considerable numbers of adults come north from Mexico in such years and appear to establish the bulk of this first spring brood that, upon emerging, flies north in tremendous migratory

movements. Tilden (1962) and papers by Abbott (summarized in Tilden's publication) present the interesting details of these migrations.

Foodplants: *Malva* species (Malvaceae), *Cirsium* (Compositae), *Urtica* species (Urticaceae), *Lupinus* species (Leguminosae), *Cryptantha* and *Amsinckia* species (Boraginaceae) and often many other plant species are used in years of exceptional abundance and migration. An enterprising lepidopterist should document the relative frequencies with which the various hosts are actually used.

Early stages (text fig. 37): The pale green, barrel-shaped egg bears 14-19 thin and high vertical ribs. The mature larva is a delicate lilac and bears five vertical lines at the junction of each segment: yellow, black, black, white, and yellow (anterior to posterior). Black spots occur over the body. Seven rows of dark spiny tubercles are present. The pupa is dark brown with raised golden points.

THE WEST COAST LADY

Cynthia annabella Field

Plate 5, figure 18 (17, *edwardsi*)

In the case of the West Coast Lady, not only her genus but her familiar species' name was lost by our California populations in Field's (1971) revision of the group. Field found that the old universally used name of *Vanessa carye* Hübner actually applies to a species of *Cynthia* found in the Andes of South America. Hence he gave a new name combination to our vanessid species, using Ventura in Ventura County (first valley one-eighth of a mile west of Arroyo Verde Park) as the source of his type specimens. *Cynthia annabella* is found from British Columbia east to Alberta and south through all the Rocky Mountain states, California, and Texas into Mexico and Guatemala. It is found throughout southern California but becomes less common in desert areas. A resident population exists on Santa Cruz Island, and the butterfly has even been taken 178 ft below sea level at Furnace Creek Ranch in Death Valley (by Langston)! In urban sections, larvae can often be found in good numbers in vacant lots where *Malva parviflora* L. is abundant. Adults can be found in every month of the year, but are only common from February to November.

Occasionally, bizarrely colored aberrations are found involving disruptions in the normal pigmentation patterns (forms "muelleri" and "letcheri" are the more extreme tendencies). It is not known if these are merely environmentally induced aberrations (e.g., cold or warm shock to the pupae) or true genetic mutations that can be inherited. Lepidopterists who catch such rare odd specimens ought to keep them alive for an extra day or two and secure eggs (if a mutant female) or a mating (if a mutant

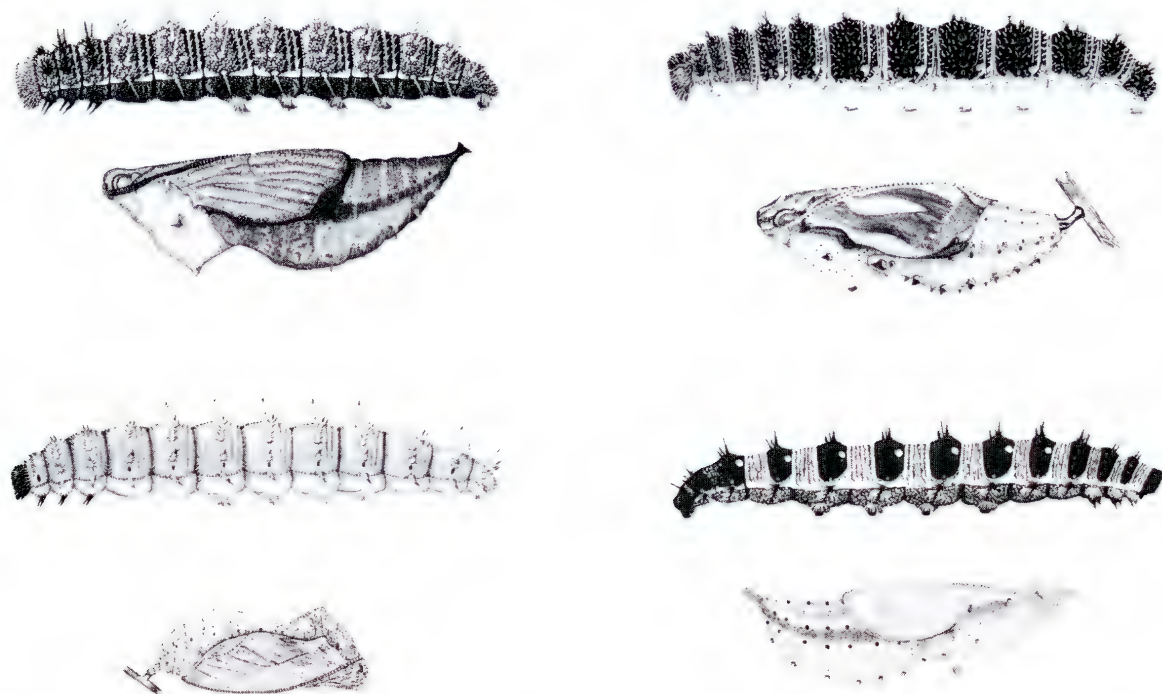


FIGURE 37. Mature larvae and pupae: *Vanessa atalanta rubria*—upper left; *Cynthia cardui*—upper right; *C. annabella*—lower left; *C. virginiensis*—lower right. (Paintings by C. M. Dammers.)

male) for genetic breeding experiments to work out the possible inheritance of these characters.

The close genetic relationship and probable generic identity of *Vanessa atalanta* and *Cynthia annabella* is shown by the occasional occurrence of natural hybrids which are phenotypically intermediate between these two species. These hybrids, named originally as a form ("edwardsi") of *V. atalanta* by Grinnell, are found in the wild with reasonable regularity. Their parental sources are indicated by information from Henne (*in litt.*), who reports that he and Ingham reared a group of larvae collected on *Urtica holosericea* in the Palos Verdes Hills, and all but three larvae produced *annabella* and *atalanta* adults. One adult was a perfect intermediate in phenotype ("edwardsi") while the two others displayed slight "edwardsi" tendencies in maculation. No *Cynthia cardui* were reared from these larvae (*C. cardui* x *V. atalanta* was thought by Comstock, 1927a, and others to be the parental source of "edwardsi").

Foodplants: *Malva* species (Malvaceae), *Urtica holosericea* Nutt. (Urticaceae) and *Sidalcea* species (Malvaceae) are regular hosts. *Sphaeralcea ambigua* Gray (Malvaceae) appears to be the principal foodplant in the deserts.

Early stages (text fig. 37): The mature larva is quite variable, but is usually blackish with numerous

orange blotches. Fine whitish hairs are scattered over the surface. There are seven rows of finely branched spines which vary in color between larvae. The pupa is glistening light brown with raised whitish points.

THE VIRGINIA LADY

Cynthia virginiensis (Drury)

Plate 5, figure 23

Not as common as its near relatives, the Virginia Lady may be still encountered almost anywhere in cismontane and lowland southern California. It is occasionally taken in the deserts. It is abundant on Santa Cruz Island (more abundant in April-June, 1966, than all other vanessids, according to Langston). The delicate cobweblike pattern of the undersides of freshly emerged adults of this species is a beautiful example of the perfection and extreme complexity of processes involved in developing the pattern of scales and colors on a butterfly's wing. *Cynthia virginiensis* is multiple brooded and is found sparingly in every month of the year in Los Angeles County; in other areas, it does not fly during the winter months.

Foodplants: *Gnaphalium* species and *Anaphalis margaritacea* (L.) Benth. & Hook (Compositae).

Early stages (text fig. 37): The yellowish green

egg is barrel-shaped and has 13-16 vertical ribs. The mature larva is a light lilac with large black patches as "saddles" around the upper five rows of black branched spines. There is a pair of subdorsal silvery white spots on abdominal segments 2-8.

THE BUCKEYE

Precis coenia (Hübner)

Plate 5, figure 22

The beautiful Buckeye with its large multi-colored ocelli occurs throughout cismontane southern California and the lowlands, but it is scarce in the deserts. It is also found on Santa Cruz Island offshore in the Channel. *Precis coenia* is a pugnacious butterfly, defending a territory around its favorite perching site with darting flights against any passing wayfarer. The species is multiple brooded and flies from March to November.

Foodplants: *Plantago erecta* Morris and *P. lanceolata* L. (Plantaginaceae); *Mimulus* and *Antirrhinum* (snapdragon) species (Scrophulariaceae).

Early stages (text fig. 38): The squatty egg is dark green. The mature larva is dark with longitudinal stripes of pale yellow and rows of branching spines. At the corners of the head occur two anteriorly-pointing spines. The pupa is usually pale wood-brown, with various mottlings of other colors.

THE DARK BUCKEYE

Precis nigrosuffusa (Barnes & McDunnough)

Plate 5, figure 21

Along the Colorado River near Blythe, this dark buckeye species with small ocelli may be taken in October and occasionally in other fall months. The stronghold of *Precis nigrosuffusa* is to the east in Arizona and Texas and to the south in the tropics of Mexico and Central America. Because of considerable seasonal and geographic variation in *Precis* species, the taxonomy of all the species in the genus is uncertain at present. Tilden (1971) has presented an excellent review of the three nearctic species and placed them in the Old World genus *Precis* instead of *Junonia* (now a synonym).

Foodplant: *Stemodia durantifolia* (L.) Sw. (Scrophulariaceae) is the suspected foodplant in the colonies in our area and in Arizona. The foodplant in Texas is *Stemodia tomentosa* (Mill.) Greem. & Thoms.

Early stages (no text fig.): Unreported at present, though reared by several workers in Texas.

THE ARIZONA VICEROY

Limenitis archippus obsoleta Edwards

Plate 5, figure 20

The Arizona Viceroy is a rare capture in southeastern California and is found only in the Colorado

River and Imperial valleys. The largest populations are said to occur along the Colorado River near Blythe, although it has not been taken in this area in recent years. It flies in the higher levels of the cottonwoods and willows. Several broods appear during the April-October flight period. The adults are excellent mimics of the distasteful Queen, *Danaus gilippus strigosus*, which are abundant in the same area.

Foodplants: *Populus* species, *Salix* species (Salicaceae).

Early stages (text fig. 38): The mature larva is totally unlike that of *Danaus gilippus*, which the adult Viceroy mimics. It is grayish white on the thorax, yellowish brown up to the mid-abdominal region, white in the middle of the abdomen, and brownish from there to the posterior end. Small nodules and spots occur over the body except in the central white patch. The larval pattern is no doubt protective, imparting a resemblance to a bird dropping. Two plumelike horns extend forward from the thorax. The pupa is equally unusual, with a highly raised hump on both the thorax and forward abdominal portion. The thorax and wing covers are brownish; the abdomen is whitish.

LORQUIN'S ADMIRAL

Limenitis lorquini lorquini (Boisduval)

Plate 5, figure 24

This delightful butterfly never fails to attract the attention of hikers or naturalists along our mountain canyons in southern California. The black and white pattern with its golden orange forewing patch is flaunted boldly in its deliberate flight. Comstock well describes the species' habits: "It frequents water courses and moist wooded areas, being especially abundant in river bottomlands that are overgrown with willow. The flight of this boldly marked butterfly is characterized by a series of short twitching motions, with the wings held nearly flat, interspersed with leisurely volplaning. Frequently stops are made on exposed perches, where it delights in basking." It flies in two broods from April to September, and diapauses as a half-grown larva in a rolled-over leaf (called a hibernaculum).

Foodplants: *Salix* species (Salicaceae); also *Prunus virginiana* L. var. *demissa* (Nutt.) Sarg. (Rosaceae) in the Tehachapi Mountains.

Early stages (text fig. 38): The nearly spherical, pale green eggs are laid singly at the tip of a leaf. The mature larva is olive-brown, with olive-yellow mottling in the thoracic area and a whitish patch above the mid abdominal region. A white lateral band runs along the nine abdominal segments. Two plumelike horns protrude forward from the center thoracic segment (mesothorax). The pupa

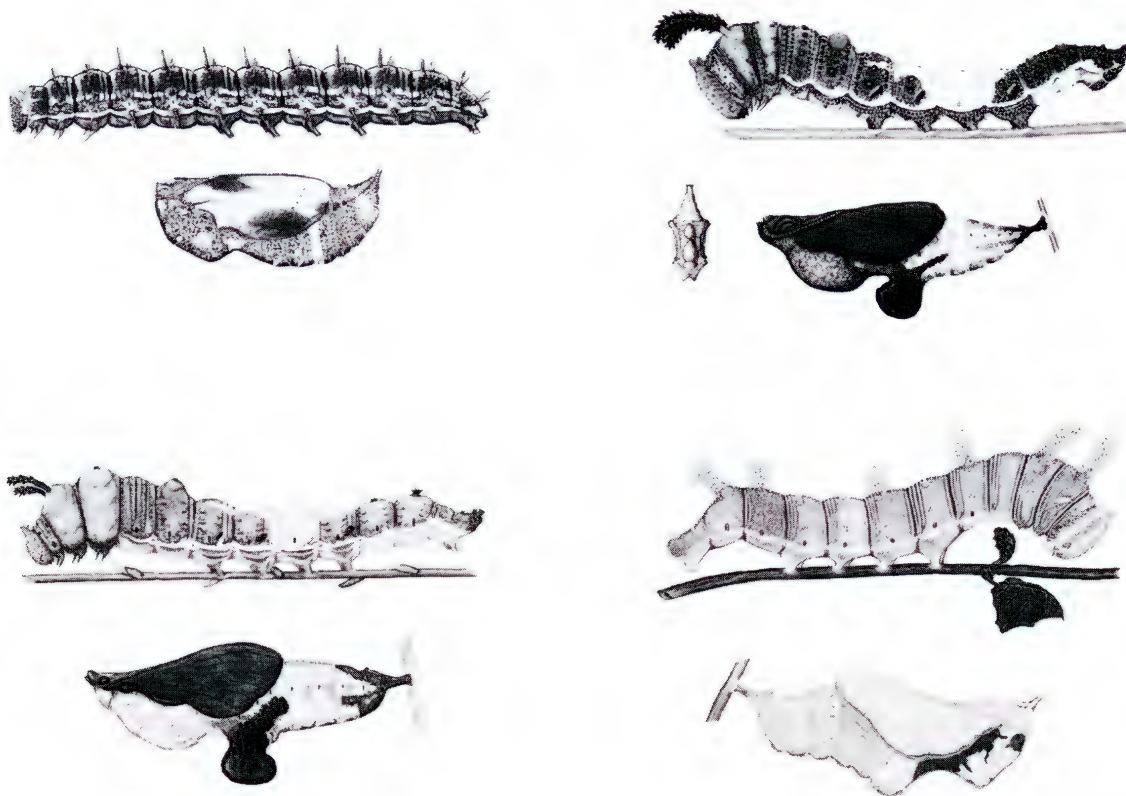


FIGURE 38. Mature larvae and pupae: *Precis coenia*—upper left; *Limenitis archippus obsoleta*—upper right; *L. lorquini*—lower left; *Adelpha bredowii californica*—lower right. (Paintings by C. M. Dammers.)

has a dorsally raised hump near the front of the abdominal region. It is dull purplish and white on the thorax, mottled white on the abdomen, and translucent dark olive-green on the wing-cases.

BREDOW'S SISTER

Adelpha bredowii (Geyer)

We have two races of Bredow's Sister in southern California:

(a) THE CALIFORNIA SISTER

Adelpha bredowii californica (Butler)

Plate 5, figure 25

The California Sister resembles the Lorquin's Admiral but can readily be distinguished by the lower placement of the orange forewing patch and the blue lines on the ventral surface of the wings. It flies in the mountains, largely in Transition Zone forest areas and canyons around oaks. The species is found on Santa Cruz Island from at least April through June. Adults often come to moisture, landing on damp sand or mud around lakes or along streams. Langston once observed them swarming

on grape squeezings at the San Gabriel River near Whittier. They rarely visit flowers, preferring to fly around the larval foodplants. The flight period extends from April to September and two broods are indicated.

(b) THE ARIZONA SISTER

Adelpha bredowii eulalia (Doubleday)

Not figured

Adelpha bredowii eulalia reaches southern California in the New York Mountains, Providence Mountains, and Granite Mountains north of Amboy, San Bernardino County. The oak foodplant, *Quercus chrysolepis* Liebm. (Fagaceae), occurs here. This subspecies flies from late May to July in one brood in these desert mountain ranges. From these localities the butterfly is scarce in collections.

These Sisters are clearly related to the neotropical nymphalid genus *Adelpha* more than to *Limenitis*, where *bredowii* is sometimes placed, on the basis of both adult and larval characters.

Foodplant: *Quercus chrysolepis* Liebm. (Fagaceae) in our area. Possibly other oak species, but none has been documented.

Early stages (text fig. 38): The mature larva is dark green above and lighter below, shading into soft brown. It is superbly camouflaged on the *Quercus* leaves and twigs. The six pairs of long fleshy tubercles are green. The pupa is soft brown, with darker striations and metallic spots on the dorsal surface.

Family LIBYTHEIDAE

The Libytheidae or snout butterflies are a small and in many ways peculiar family. The group has an ancient history, being represented in the fossil shales of Florissant, Colorado, by a species (*Prolibythea vagabunda* Scudder) that flew thirty million years ago and very probably fed on *Celtis maccoshi* Lesq., the only fossil hackberry tree in that location and representing a species in the only host genus utilized by the family today. Another extraordinary eccentricity is the fact that the snout butterflies are found on every continent, but there are only ten living species and usually only one species is found in any particular region. The principal distinguishing characters are the excessive length of the palpi at the front of the head (forming the "snout"), the much reduced forelegs in the male but well-developed forelegs in the female, and the plain elongated larvae which resemble those of the Pieridae.

THE SNOOT BUTTERFLY

Libytheana bachmanii larvata (Strecker)

Plate 5, figure 26

The Snout Butterfly is widely distributed in the eastern half of the United States, southern Arizona and Mexico. In southeastern California it normally occurs as a stray in the Colorado and southern Mojave deserts and occasionally Orange County (Balboa Island, Garden Grove). It is also known from Darwin Falls in Inyo County (25 October 1935), Sagamore Canyon in the New York Mountains (16 September 1935), and Little Rock Creek in Los Angeles County (8 November 1961), all collected by Chris Henne. It becomes rather common in the late fall (especially October) in Imperial County, Coyote Canyon southeast of Anza in Riverside County, and in the area just north of Banning, Riverside County. At the latter site there is a colony of *Celtis douglasii* Planch. (Ulmaceae), one of the few spots in California where a native hackberry grows (another is Clark Mountain). Most adult specimens have been taken in the fall months on blooming Rabbitbrush (*Chrysothamnus*).

Foodplant: The species may become temporarily established on *Celtis douglasii* Planch. (Ulmaceae) which is found in a few scattered canyons in our area.



FIGURE 39. Eggs, larvae and pupa: *Libytheana bachmanii*. (From Edwards, 1884.)

Early stages (text fig. 39): The conoidal egg is pale green. The mature larva is quite variable in color and pattern, but is generally dark green with a yellow middorsal line and a lateral line. The pupa also varies, with the usual color being green with yellow lines and spots placed as shown in the figure.

Family LYCAENIDAE

The lycaenids are a large family of small to medium sized butterflies, often having bright metallic colors. The family includes the metalmarks, hairstreaks, coppers, and blues. Structurally, the lycaenids are distinctive because of the flat face between their eyes, the reduction of the forelegs in the male and full development of the forelegs in the female, the notching of the eyes around the antennal bases, and the flattened, sluglike larvae.

The metalmarks of the subfamily RIODININAE are an extremely diverse and well developed group in the American tropics, and are often accorded full family status by lepidopterists. After landing or when resting, they hold their wings spread horizontally. The chief diagnostic character besides the usual metallic spots and iridescent colors is the notable extension of the first leg segment (coxa) beyond the joint of the next segment (trochanter), on the reduced prolegs of the male.

The hairstreaks of the subfamily THECLINAE hold their wings above their backs when they alight and usually have tiny hairlike "tails" on the hindwings. The underside commonly has fine, streaked lines as part of the pattern (hence the derivation of the common name). They fly in a very rapid, jerky, darting flight.

The coppers of the subfamily LYCAENINAE have brilliant metallic copper-orange uppersides (or in one case, blue) and are stout-bodied, fast-flying butterflies. Important differences from the three other lycaenid groups are found in the venation of the wings. They are a temperate group of both the northern and southern hemispheres.

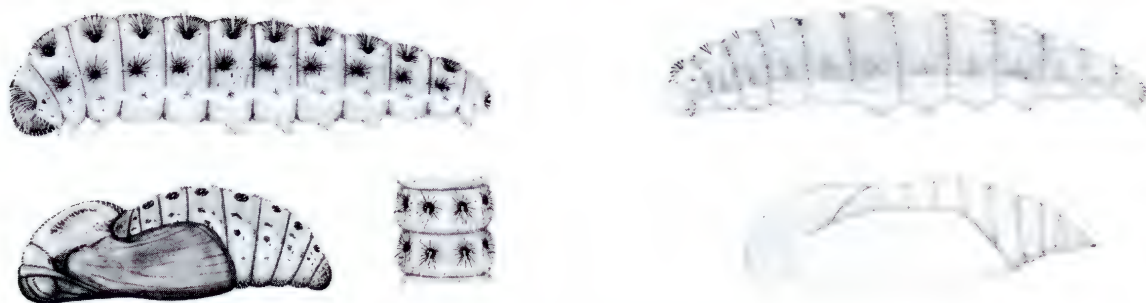


FIGURE 40. Mature larvae and pupae: *Apodemia m. mormo*—left; *A. palmerii marginalis*—right. (Paintings by C. M. Dammers.)

The blues of the subfamily PLEBEJINAE reach their greatest diversity north of the tropics in both the Old and New Worlds. The males are generally bright blue and the females brownish. The head is narrow and the feet (tarsi) bear few spines compared to those of the other lycaenids. The larvae are commonly tended by ants and possess one or more "honeydew" secreting glands which exude a sweet fluid onto the dorsal surface through a duct at the seventh abdominal segment. The compact, almost rounded pupae are frequently hairy or minutely spiny, and usually the pupal stage is passed underground or in litter at the base of the foodplant.

THE MORMON METALMARK

Apodemia mormo (Felder & Felder)

This widely distributed polytypic butterfly occurs throughout the arid regions of the western United States and northern Mexico. Southern California has the extraordinary situation of supporting populations representing five of the nine recognized subspecies (see Opler & Powell, 1961, for a thorough discussion of the group):

(a) THE MORMON METALMARK

Apodemia mormo mormo (Felder & Felder)

Plate 5, figure 29

The Mormon Metalmark in its typical form ranges from Salt Lake City, Utah, to southern California and Arizona. It is characterized by the uniform ashen gray ground color on the dorsal hindwing surface and the extensive amount of white ventrally. In our area it is found in the Argus Mountains and other areas in Inyo County; the Ivanpah, New York, Providence, and Ord mountains, as well as other areas in eastern and western San Bernardino County; and Desert Center in Riverside County. It blends with *A. mormo virgulti* along the northeastern slope of the San Gabriel Mountains adjoining the Mojave Desert, from Palmdale (Los Angeles County) eastward to the end of the San Bernardino

Mountains. Also in this area, Henne has taken a *cythera*-like phenotype, associated with an *Eriogonum wrightii* subspecies at Mile High, with *E. nudum* (near *saxicola*) at Big Rock Creek, and with *E. elongatum* in the Sierra Pelona southwest of Palmdale. These *cythera* individuals appear to be distinct from local *virgulti* and *mormo* types, and the situation may represent a case of sympatric subspecies which remain distinct because of their separate foodplants.

The flight period is April to June and August to September. The populations apparently are double brooded, although specimens collected at both seasons from one area seem to be lacking.

Foodplants: Probably *Eriogonum fasciculatum* Benth. ssp. *polifolium* (Benth.) S. Stokes and *E. plumatella* Dur. & Hilg. (Polygonaceae) in the southern California portion of the butterfly's range.

(b) EDWARD'S METALMARK

Apodemia mormo cythera (Edwards)

Plate 5, figures 32, 33

Apodemia mormo cythera occurs along the east slope of the Sierra Nevada and swings down into our area on Walker Pass and at Dove Springs in Kern County. It flies in September at Walker Pass and the Piute Mountains, and in April at nearby Dove Springs, but it is uncertain whether these data indicate two annual generations at each site since the subspecies is single brooded (flying in the summer) slightly further north. The race is characterized by a greater extent of orange on both the dorsal and ventral surfaces of the forewing, the orange postmedial band of the hindwing, and the pale, whitish underside of the hindwing.

Foodplant: Probably *Eriogonum fasciculatum* Benth. ssp. *polifolium* (Benth.) S. Stokes (Polygonaceae).

(c) BEHR'S METALMARK

Apodemia mormo virgulti (Behr)

Plate 5, figures 30, 31

Behr's Metalmark is distinguished from the other *mormo* races by its darker aspect and the presence of reddish orange areas on the dorsal surface of both forewings and hindwings. It occurs throughout the chaparral zones of cismontane southern California in association with wild buckwheat, *Eriogonum fasciculatum* Benth. It is double brooded, flying in March and April and again in August and September in the same areas.

Foodplants: *Eriogonum fasciculatum* Benth. ssp. *fasciculatum* Benth. and ssp. *polifolium* (Benth.) S. Stokes (Polygonaceae).

(d) THE DESERT METALMARK

Apodemia mormo deserti Barnes & McDunnough
Plate 5, figures 34, 35

The Desert Metalmark occurs in the western Colorado Desert foothills from the border of San Bernardino and Riverside counties at Morongo Valley and the Palm Springs area south to San Diego County and the Anza Desert. The butterfly does not occur in the western Mojave Desert, contrary to earlier authors; those populations fall under *A. m. mormo*, according to Opler & Powell (1961). True *A. m. deserti* is characterized by a general pale aspect due to lighter ground color, enlarged white spots, particularly those of the terminal band, and extensive white scaling on the ventral hindwing surface. The normal double brooded flight period is March to April and September to November, although a few specimens are recorded from January, July and August. The timing of the fall brood is correlated with the extent of summer and early fall rainfall.

Early stage (text fig. 41): The larval hairs of this race are longer than those of the typical race.

Foodplants: *Eriogonum inflatum* (Benth.) S. Stokes; also, probably *E. fasciculatum* Benth. ssp. *polifolium* (Benth.) S. Stokes (Polygonaceae).

(e) THE WHITISH METALMARK

Apodemia mormo near *dialeuca* Opler & Powell,
Plate 5, figure 36

The high montane populations in the San Bernardino Mountains are characterized by greatly enlarged white spots and reduced orange, diagnostic features of the Baja California montane race *A. m. dialeuca*. These high-altitude populations in San Bernardino County use a prostrate *Eriogonum* as foodplant.

Foodplants: Probably *Eriogonum kennedyi* Porter ssp. *austromontanum* (M. & J.) S. Stokes or *E. wrightii* Torr. ssp. *subscaposum* (Wats.) S. Stokes (Polygonaceae).

Early stages (text fig. 40): The life history for all the subspecies may be similar, but careful compara-



FIGURE 41. Mature larva: *Apodemia mormo deserti*. Note long hairs as compared to typical race. (Photograph by T. C. Emmel.)

tive studies are still lacking. The following descriptions apply to *Apodemia mormo mormo* material (figured, along with a photograph of the *A. mormo deserti* larva). The egg is a delicate pink. The mature larva is rather dark violet above and lighter below the spiracles. The four subdorsal rows of pin cushions of spines have black bases. The lateral row of pin cushions of long hairy spines (below the spiracles) are ochre in color. The species hibernates as partly grown larvae in the second generation. The pupa is mostly flattened on the ventral surface and is covered with hairs except ventrally. The ground color is a mottled brown.

PALMER'S METALMARK

Apodemia palmerii marginalis Skinner
Plate 5, figures 37-39

This jaunty and attractive little metalmark occurs in the Coachella, Imperial and Colorado River valleys of southeastern California. It is a desert species, and captures have been recorded in April, from June to August, and again in October and November, so the species probably goes through either two or three broods, depending upon rainfall. It is puzzling that this butterfly's distribution in California should be so spotty and limited considering the wide extent of its foodplant's distribution.

Foodplant: Honey Mesquite, *Prosopis juliflora* (Sw.) DC. var. *torreyana* L. Benson (Leguminosae), according to Dammers.

Early stages (text fig. 40): Described in great detail by Comstock & Dammers (1932). The light green egg is a flattened hemisphere, covered with hexagonal cells formed by raised walls. The mature larva is a pale bluish green, with a lemon yellow middorsal line and a subdorsal line of similar color. Six rows of whitish hair tufts are present. The pupa

is a pale bluish green with lighter, straw colored wing cases. Comstock and Dammers comment that "The larvae of this species spend their entire life, except when feeding, thoroughly concealed in a silk nest formed by drawing two leaflets together. In early February [eggs were laid on October 25 and hatched November 4th] they were only in their third instar, having fed only occasionally during the winter, but never going into true hibernation. As soon as the new spring growth of the foodplant was given them, they rapidly reached maturity. Imagos emerged April 19th to early May"

THE DUSKY METALMARK

Calephelis nemesi (Edwards)

This small metalmark with drab upper wings but bright orange undersides occurs as two subspecies in our area. An outstandingly complete monographic treatment has recently appeared on the whole genus of these taxonomically difficult butterflies (McAlpine, 1971).

(a) DAMMER'S METALMARK

Calephelis nemesi dammersi McAlpine

Plate 5, figure 40

Dammer's Metalmark is presently known only from the Colorado River Valley around Blythe. It is notably lighter in color and smaller than *C. n. californica*; genitalic differences between the subspecies exist. As far as is known, it flies only in mid-summer in July.

Nothing is known of its early stages; the foodplant is suspected (Dammers, *in litt.*) to be *Baccharis glutinosa* Pers. (Compositae).

(b) THE DUSKY METALMARK

Calephelis nemesi californica McAlpine

Plate 5, figures 41, 42

This metalmark is darker (actually a pale chocolate brown) than the preceding form, and both forewings and hindwings are crossed in the middle by a prominent irregular darker brown shade or band. It is distributed generally in the lower canyons and chaparral areas near the coast in Los Angeles, Orange, western Riverside, and San Diego counties. The flight period is recorded from February to early October and probably involves three broods near the coast.

Foodplants: *Baccharis glutinosa* Pers. (Compositae) in Riverside County (see Comstock & Dammers, 1932), and *Encelia californica* Nutt. (Compositae) at Hermosa Beach (Henne and Ingham records) and probably in all other coastal populations, including the Santa Monica Mountains and Baldwin Hills in Los Angeles County, where *B. glutinosa* does not seem to occur.

Early stages (text fig. 42): The mature larva is dark gray and profusely covered with minute silvery nodules and rows of tufts of long, grayish white and buff or (rarely) brown hairs. The dorsal lines of tufted hairs are inclined towards the center and thus meet over the back, while the lower series extend horizontally and lie flat on the rather silvery whitish surface of the host plant leaf. The pupa is pale dirty yellow, with a few brown dots and dashes. Clumps of yellowish hairs are arranged over the surface as shown in the accompanying figures. It is suspended with a supporting thoracic girdle and silken button for attachment of the cremaster hooks, like a papilionid or pierid pupa.

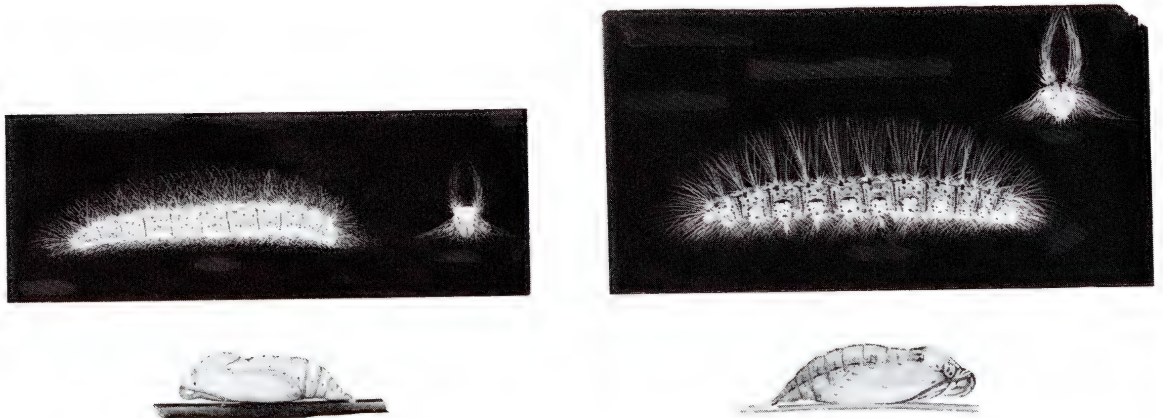


FIGURE 42. Mature larvae (including anterior view) and pupae: *Calephelis nemesi californica*—left; *C. wrighti*—right. (Paintings by C. M. Dammers.)

WRIGHT'S METALMARK

Calephelis wrighti Holland

Plate 5, figures 43-45

Wright's Metalmark is a rather uniform reddish brown dorsally, and the entire surface seems to be overlaid with a faint delicate whitish sheen in fresh specimens. The fringes on both forewings and hindwings are conspicuously checkered with white. These diagnostic characters (McAlpine, 1971) along with the genitalia distinguish it from our other *Calephelis*. Wright's Metalmark flies on the Colorado Desert and some parts of cismontane southern California adjacent to this desert (e.g., eastern San Diego County), as well as into southwestern Arizona and northern Mexico. It flies on the coastal side of the San Diego mountains at Lakeside. It can be taken in fair abundance in the canyons along the western border of the Colorado Desert from March to October, with the timing of the summer and fall broods depending upon summer rains.

Foodplant: *Bebbia juncea* (Benth.) Greene (Compositae). The larva is said to feed on the greenish epidermis of the stems (Comstock, 1928b).

Early stages (text fig. 42): Described under the misnomer, *Calephelis australis* Edwards, by Comstock (1928b). The egg is echinoid (like a sea urchin skeleton in shape) and covered with deep hexagonal cells. The last instar is grayish white, the surface covered with raised white nodules. Rows of other nodules bear long filamentous white hairs. The spiracles are yellow and above each one is a lighter, irregular square-shaped area, margined above with black. The pupa is a light grayish green, with brown tinges posteriorly. Series of tubercles bearing short hairs occur over the surface except on the bare wing covers.

BOISDUVAL'S HAIRSTREAK

Habrodais grunus grunus (Boisduval)

Plate 5, figures 46, 47

Boisduval's Hairstreak occurs throughout the oak belt and Transition Zone of the foothills and mountains of southern California, wherever Canyon Oak (*Quercus chrysolepis*) grows. The sole exceptions to this wide distribution pattern are the ranges of the eastern Mojave Desert, where *Q. chrysolepis* grows but *Habrodais* has never been taken. The rather dull colored adults frequently perch on protruding oak branches from which they dart out to challenge any passing colleague. The species is single brooded and flies from June to August. It often becomes very abundant around its foodplant. The adults are crepuscular, especially flying in the early morning or evening hours.

Foodplant: *Quercus chrysolepis* Liebm. (Fagaceae).

Early stages (text fig. 42): The species overwinters in the egg stage (concealed on oak twigs). The larvae then feed on the tender new growth of the oak in the spring months. The slug-shaped mature larva is pale bluish green, with many yellowish brown punctae each supporting a single silvery white hair. There is a subdorsal white or pale yellowish line along the body. Immediately behind the flattened head is a cervical shield below which the head can be withdrawn; this shield area is free of hairs. The pupa is pale bluish green and is covered with minute short white hairs as well as olive-brown punctae of various sizes. Pupation occurs on the foodplant, using a cremaster and a silk girdle for support. The pupal stage lasts 15 days (see Comstock & Dammers, 1935a).

THE GREAT PURPLE HAIRSTREAK

Atlides halesus corcorani Gunder

Plate 5, figures 27, 28

This spectacular iridescent hairstreak is found rather sparingly in the Lower Sonoran, Upper Sonoran, and Transition Zones in southern California, particularly in the deserts and cismontane areas. It is most numerous along watercourses where its mistletoe foodplants are abundant on cottonwoods and sycamores. Although adults are usually taken as singletons, occasionally one finds fairly good numbers on flowers. Pupation takes place under the bark of or at the base of trees on which the mistletoe grows. Pupae can sometimes be found in large numbers at the bases of isolated trees with heavy growths of mistletoe. A prime series of sites lies along the Santa Ana River in Riverside County, where as many as 420 pupae have been collected under one tree! The flight period of this multiple brooded species is late March to early October.

Foodplants: *Phoradendron flavescens* (Pursh.) Nutt. var. *macrophyllum* Engelm., *P. bolleanum* (Seem.) Eichler var. *densum* (Torr.) Fosb.; probably also *P. californicum* Nutt. and *P. juniperinum* Engelm. (Loranthaceae).

Early stages (text fig. 43): The mature larva is green and appears velvety due to the covering of short orange hairs (except on the center portion of the cervical shield). The pupa is brown and mottled with black. Short yellow-orange hairs are scattered over the surface except on the wing cases.

THE AVALON HAIRSTREAK

Strymon avalona (Wright)

Plate 6, figures 1, 2

The Avalon Hairstreak is one of the world's most restricted species, being found only on Santa Cata-

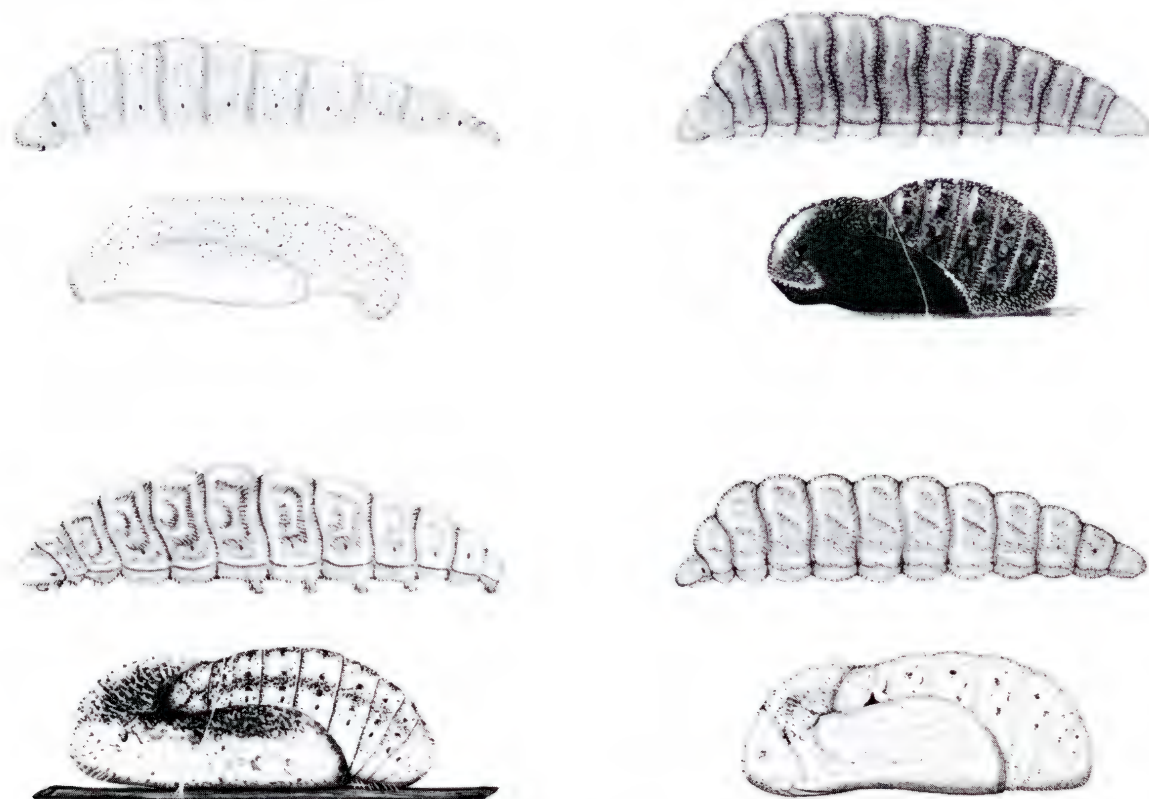


FIGURE 43. Mature larvae and pupae: *Habrodais grunus*—upper left; *Atlides halesus corcorani*—upper right; *Strymon avalona*—lower left; *S. melinus pudica*—lower right. (Paintings by C. M. Dammers.)

lina Island off the coast of southern California. It rather resembles *Strymon melinus*, but is smaller and lacks the heavy wavy black line that *melinus* has on the ventral surface. The normal flight period extends from February to October, though the early spring brood is by far the largest. *Strymon avalona* is common in select localities such as the hills around Avalon, the type locality. Meadows (1936) states that perhaps the best collecting locality is around common sumac (*Rhus laurina*) along the road to Renton Mine, south of Avalon, in early March. The adults also visit the flowers of the giant buckwheat, *Eriogonum giganteum* Wats.

Foodplants: *Lotus argophyllus* (Gray) Greene var. *ornithopus* (Greene) Ottley, and *L. scoparius* (Nutt.) Ottley (Leguminosae).

Early stages (text fig. 43): Described by Comstock & Dammers, 1933. The eggs are gray-green, with a blue cast, and are laid singly, usually in the terminal buds or on immature flowers of the food-plant. The mature larvae show much variation in color, ranging from pale apple green to pale pink. The body is covered with short white pile. The pupa is pale pinkish brown or wood brown, shading to

buff on the abdomen. Superimposed on this background are markings of various shades of olive.

THE COMMON HAIRSTREAK

Strymon melinus pudica (Hy. Edwards)

Plate 6, figures 3, 4

This dark gray hairstreak occurs throughout the lowlands and up to the Transition Zone in the mountains of southern California. It is scarcer in desert areas. The flight period of this multiple brooded butterfly is February to November. The adults are abundant in urban areas in the summer and fall months, visiting many kinds of flowers to sip nectar. While perched, they frequently rub the hindwings together. The species sometimes becomes a pest in bean fields.

Curiously, *Strymon melinus* has not been found on Catalina Island (Meadows, 1936), but it does occur in great abundance on Santa Cruz Island to the north (Langston, records in April and June) where *Strymon avalona* is absent. Perhaps competitive exclusion in some way prevents both species from becoming established on one island.

Foodplants: Many genera in several families are

used. These include *Malva* and flowers of cultivated *Hibiscus* in urban areas (Hogue) (Malvaceae), *Humulus* (Moraceae), *Amorpha* (Leguminosae), *Nolina* (Agavaceae), *Phaseolus* (Leguminosae), *Polygonum* and *Eriogonum* (Polygonaceae).

Early stages (text fig. 43): The flattened egg is green. The variable mature larvae are green with diagonal markings of diverse colors on each segment. The surface is covered with short yellowish brown hairs. The pupa is a delicate brown, heavily mottled with dark brown spots of various sizes.

THE COLUMELLA HAIRSTREAK

Strymon columella istapa (Reakirt)

Plate 6, figures 5-7

The Columella Hairstreak is quite scarce in southern California and has only been taken in the Colorado Desert, particularly the Coachella, Imperial, and Colorado River valleys. The Bard and Winterhaven areas of Imperial County, and Yaqui Wells, the Anza Desert area in general, and El Cajon in San Diego County are the main sources of specimens in collections. The flight period provided by these records is mid-August to mid-October. The adults are distinguished from other *Strymon* by the single pair of tails and the ventral markings.

Foodplant: *Sida hederacea* (Dougl.) Torr. (Malvaceae), at the California Lakes in Imperial County (see Comstock & Dammers, 1935b).

Early stages (text fig. 44): The flattened egg is pea green in color. The eggs hatch in as little as seven days. The larvae may be fed common mallow in the laboratory. The mature fifth instar larva is dark green with a slightly darker middorsal line and a soiled white cervical shield (maroon shading in its center). The body is covered with translucent white points, from which arise translucent hairs of a glistening chestnut brown. The pupa is a pink-buff, heavily sprinkled with minute brown specks. There is a greenish middorsal band on the abdomen which bifurcates and curves to either side on the last three segments. Comstock & Dammers (1935b) provide more complete details.

THE SARITA HAIRSTREAK

Chlorostrymon simaethis sarita (Skinner)

Plate 6, figure 33

This exquisite little hairstreak with yellow-green undersides is found as a straggler in San Diego County; it is resident and often abundant in Baja California. Most of our southern California records are from October in the Vallecitos Creek and Mason

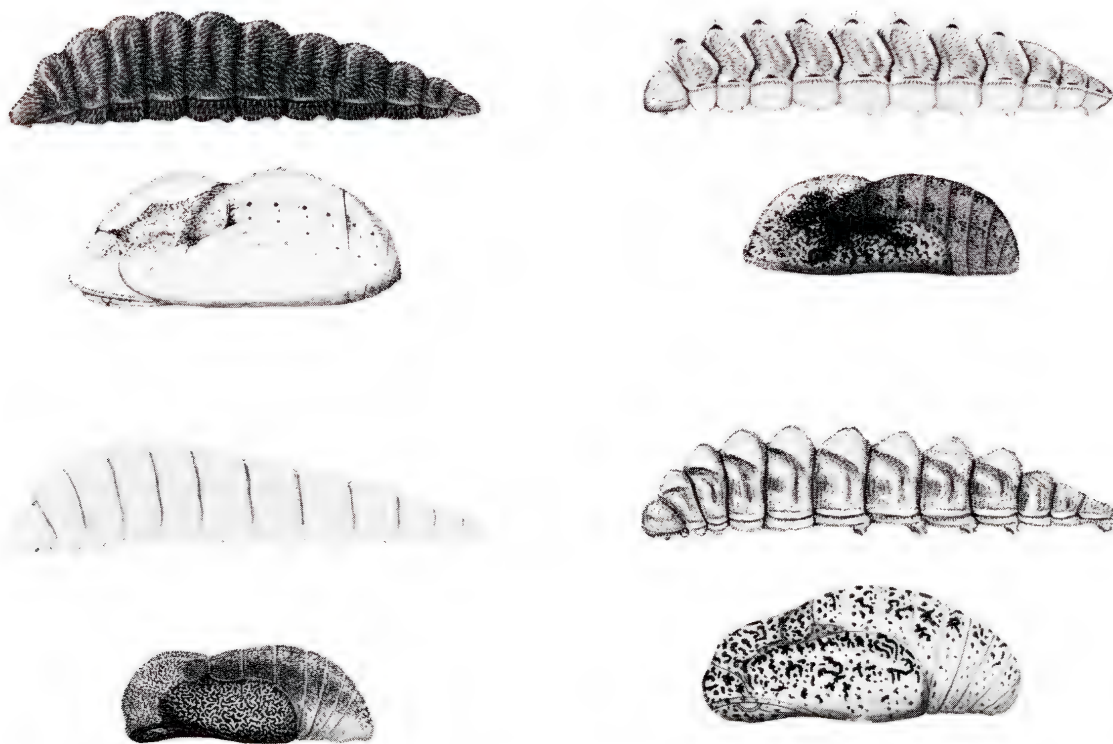


FIGURE 44. Mature larvae and pupae: *Strymon columella istapa*—upper left; *Ministrymon leda*—upper right; *Satyrium sylvinus*—lower left; *S. behrii*—lower right. (Paintings by C. M. Dammers.)

Valley area of San Diego County. The presumed foodplant in Mexico does not occur here.

Foodplant: In Baja California the butterfly is found in association with Balloon Vine (*Cardiospermum*), possibly the larval host.

Early stages (no text fig.): Unknown.

THE LEDA HAIRSTREAK

Ministrymon leda (Edwards)

Plate 6, figures 8-10

The Leda Hairstreak is found on the Colorado and eastern Mojave Deserts (e.g., New York Mountains) from May to October. It is multiple brooded. Adults are not uncommon on blooms of various plants in the desert areas of San Diego County, east of the Laguna Mountains, in September and October. Scissors Crossing is a favorite locality for this species. It has also been taken near the south summit of Mt. Palomar, San Diego County, in July.

Foodplant: Honey Mesquite, *Prosopis juliflora* (Sw.) DC. var. *torreyana* L. Benson (Leguminosae).

Early stages (text fig. 44): Described by Comstock & Dammers, 1936.

The eggs are pale green with white reticulations, and blend well with the mesquite blossoms on which they are laid. The ground color of the mature larva is apple green. The body is sparingly covered with short, thick, chestnut hairs. On the dorsum, there is a series of yellowish white chevron markings. The pupa is pale olive-brown and chestnut, with black stippling and blotching.

THE INES HAIRSTREAK

Ministrymon ines (Edwards)

Plate 6, figure 11

The status of *Ministrymon ines* and the preceding species, *M. leda*, is a most perplexing one. Compared to the Leda Hairstreak, the Ines Hairstreak has a much reduced or absent red line on the ventral hindwing surface, and between this line and the body lies a darker gray pattern. The distribution of *M. ines* is nearly identical to that of *M. leda*. However, Forbes (*in litt.*) reports that *M. ines* flies in one brood (July) in the desert areas of San Diego County while *M. leda* flies in September and October. *M. ines* occurs in considerably smaller populations. Unpublished studies by Roever in Arizona (and records from Scissors Crossing by Langston) suggest that *M. leda* flies from May to July as a spring form, "leda," and that the second brood of this butterfly emerges as form "ines" in late September to November. Even from these contradictory data, there is still the implied possibility that these are two distinct species partially separated by seasonal isolation. The course followed here is to treat them as two species until the confusion can be lifted

through more detailed field observations and systematic laboratory rearing studies.

Foodplant: *Prosopis juliflora* (Sw.) DC. var. *torreyana* L. Benson (Leguminosae).

Early stages (no text fig.): Undescribed.

THE CALIFORNIA HAIRSTREAK

Satyrium californica (Edwards)

Plate 6, figures 12-14

The California Hairstreak is found in the higher mountains of southern California, including the chaparral and Transition zones. It is abundant in the Tehachapi and Greenhorn Mountains, the San Bernardino, San Gabriel, and San Jacinto mountains, on Santiago Peak in Orange County, and throughout the mountains of San Diego County. The adults frequently visit flowers. The flight period for the single brood is June to early August. *S. californica* may be distinguished from *S. sylvinus* by its darker underside.

Foodplant: *Quercus* species (Fagaceae).

Early stages (text fig. 45): Described by Comstock, 1933.

The mature larva is gray-brown with large, subovate, gray spots, one to a segment, in the middorsal region. Lateral to these spots are narrow, white chevron markings. The abdominal surface is gray-green or soiled ivory. The pupa is red-brown with ivory-green wing cases; the surface is mottled with black spots.

THE SYLVAN HAIRSTREAK

Satyrium sylvinus (Boisduval)

The Sylvan Hairstreak occurs as three subspecies in our area. It is always found in association with willows in foothill and mountain canyons.

(a) THE SYLVAN HAIRSTREAK

Satyrium sylvinus sylvinus (Boisduval)

Plate 6, figures 15-17

The typical subspecies is found along streams in the Upper Sonoran and Transition zones from Los Angeles County south to San Diego. The flight period for the single brood is June to August. It overwinters in the egg stage. It ranges into northern California along the Sierra Nevada Mountains and foothill areas.

Foodplants: Willows, *Salix* species (Salicaceae); precisely which species is not known.

Early stages (text fig. 44): Described by Comstock & Dammers, 1934.

The ova are laid singly on the willow stems. The mature larva is pale apple green. There is a subdorsal, thin white band running longitudinally, and lateral to this on each segment are two diagonal white bars. The pupa is pale greenish brown with



FIGURE 45. Mature larvae and pupae: *Satyrium californica*—left (from Comstock, 1933); *S. s. saepium*—right (from Comstock, 1933).

pale olive green thorax and wing cases. It is heavily spotted with dark olive green and brown.

(b) THE DESERT HAIRSTREAK

Satyrium sylvinus desertorum (Grinnell)

Plate 6, figure 21

This lighter subspecies occurs on the eastern desert slopes of the Tehachapi Mountains (type locality: Oak Creek in Kern County). It flies in late June and early July. The foodplant and life history are undescribed.

(c) THE DRYOPE HAIRSTREAK

Satyrium sylvinus dryope (Edwards)

Plate 6, figures 18-20

In southern California, this *tailless* subspecies with lighter ventral spotting is found from the old Ridge Route and Mt. Pinos region in Los Angeles County north in the coast ranges through Ventura, Santa Barbara, and San Luis Obispo counties. It also occurs in central and northern California in a restricted range. The flight period is late May to July. In the western portion of the San Gabriel Mountains there may be a blend zone of *dryope* and typical *sylvinus* populations.

Although some recent authors have considered *dryope* to be a distinct species, we are convinced that it is merely a subspecies of *Satyrium sylvinus*.

Foodplants: *Salix* species (Salicaceae) (Emmel & Emmel, 1968).

Early stages (no text fig.): Only the first instar has been described (Emmel & Emmel, 1968). The ground color is a uniform gray, with small, dark brown elevated points distributed over the body. Both the head shield and the anal shield are yellowish green, outlined in brown. The spines on all segments of the body and head are translucent, with a dark gray ring at the base of each.

BEHR'S HAIRSTREAK

Satyrium behrri behrri (Edwards)

Plate 6, figures 22, 23

In our area, this distinctive tailless hairstreak occurs solely in the Mt. Pinos region of Ventura and Kern counties, the Tehachapis, and along the northern slopes of the San Gabriel and San Bernardino mountains. It may also be found eventually in the western end of Joshua Tree National Monument and in scattered localities along the western edge of the Colorado Desert, where *Purshia glandulosa* is found. Diligent searching may find the species in eastern San Diego County where a few scattered *Purshia* colonies exist. The flight period of the single brood is June to early July.

Foodplant: *Purshia glandulosa* Curran in our area and *P. tridentata* (Pursh) DC. north of here (family Rosaceae).

Early stages (text fig. 44): The species overwinters in the egg stage. The quite cryptically colored larvae may be beaten from *Purshia* plants in April and May. The larvae and pupae were first described by Comstock (1928). The mature larva is predominantly green. On each segment, a dark green area lies to either side of a narrow whitish middorsal line, as well as diagonal lines of yellow, white and green. The lower lateral lines are yellow and dark green. The entire body is covered with minute short yellowish hairs. The pupa is light tan with blotches of dark brown and a few scattered short hairs on the head and dorsum.

THE NUT-BROWN HAIRSTREAK

Satyrium auretteorum spadix (Hy. Edwards)

Plate 6, figures 24-26

The Nut-Brown Hairstreak is the southern race of a northern California species. It occurs in scattered populations throughout cismontane southern California in chaparral areas, from the eastern

slope of the Greenhorn Mountains to the Laguna Mountains in San Diego County. At times it is quite numerous on milkweed blossoms. A very large colony exists at Cajon Pass where *Quercus dumosa* is abundant. In the western Santa Monica Mountains, near Malibu Lake, a population is found with somewhat darker undersides than typical *spadix*. The flight period for the single brood is mid-June to late July. The male is a uniform dark brown on the dorsal surface, while the female is lighter brown with a yellow-brown area in the center of the forewing.

Foodplant: *Quercus dumosa* Nutt.; also probably *Q. wislizenii* A. DC. (Fagaceae).

Early stages (text fig. 47): Described by Comstock & Dammers, 1934. The species overwinters in the egg stage. In the spring, the larvae feed on the tender new shoots of oak leaves.

The egg is mauve, and covered with long, green spicules. The color of the mature larva varies from pale orange to apple green. It is covered with soiled white punctae from which arise short orange chestnut hairs. The pupa is usually pinkish buff, sparingly sprinkled with dark brown spots of varying sizes.

THE GRAY HAIRSTREAK

Satyrium tetra (Edwards)

Plate 6, figures 27-29

The Gray Hairstreak ranges throughout cismontane southern California and is a common inhabitant of the chaparral. Adults can be taken in large numbers in some localities as they visit *Eriogonum fasciculatum* flowers. The single brood flies from mid-June to the end of July. This species was formerly known as *S. adenostomatis* Watson & Comstock.

Foodplant: Mountain Mahogany, *Cercocarpus betuloides* Nutt. ex T. & G. (Rosaceae). Comstock (1927a) erroneously lists *Adenostoma* as the foodplant; it is merely a common chaparral associate of *Cercocarpus*.

Early stages (text fig. 47): This hairstreak overwinters in the egg stage. The mature larva is pale apple green. Each segment bears four bluish white raised bands covered with erect short orange hairs. The distinctive cervical shield has a broad orange band on each side of the middorsal line. Pupation takes place on the foodplant in early June and the pupa is suspended by the usual silken girdle and cremasteric button. The pupa is pale mahogany brown with heavy black blotching. In recording this life history, Comstock and Dammers (1935c) state that their field-collected larvae (from Forest Home in the San Bernardino Mountains) were heavily parasitized by the ichneumonid wasp, *Anisobas bicolor* Cush.

THE HEDGE-ROW HAIRSTREAK

Satyrium saepium saepium (Boisduval)

Plate 6, figures 30-32

This fine hairstreak is a common butterfly in the Upper Sonoran Zone throughout cismontane southern California. True *S. saepium saepium* Boisduval is a Sierran butterfly. It is the most abundant hairstreak in the chaparral during its single brooded flight season of late May to July, while occasional early specimens appear in April. The adults are often seen in large numbers on flowers of shrubs such as *Eriodictyon* and *Eriogonum fasciculatum* Benth. A sizeable population of *S. saepium* form "chlorophora" (Watson & Comstock) exists on Santa Cruz Island and flies from at least late April to June (Langston).

Foodplant: *Ceanothus cuneatus* (Hook.) Nutt. and undoubtedly other *Ceanothus* species (Rhamnaceae).

Early stages (text figs. 45, 46): Described by Comstock & Dammers, 1933.

The egg is a delicate gray-green. The mature larva is green, blending well with the leaves of the foodplant. Dorsolaterally, there are faint, light



FIGURE 46. Mature larva on host: *Satyrium s. saepium*.



FIGURE 47. Mature larvae and pupae: *Satyrium auretorum spadix*—upper left; *S. tetra*—upper right; *Mitoura spinetorum*—lower left; *M. nelsoni*—lower right. (Paintings by C. M. Dammers.)

greenish yellow chevron markings. The pupa is wood brown, with a profuse sprinkling of black.

THE THICKET HAIRSTREAK

Mitoura spinetorum (Hewitson)

Plate 6, figures 34-36

This rare butterfly may be sought in the Upper Sonoran and Transition zones of southern California wherever conifers with the proper dwarf mistletoes grow. In the eastern Mojave ranges (e.g., the Providence Mountains) *Mitoura spinetorum* flies in the pinyon pine zone. It is uncommonly taken in all localities, perhaps because the mistletoes foodplants grow high in their host trees, drawing the butterflies away from the usual collecting haunts of lepidopterists. Mud and flowers attract adults and both sexes occasionally hilltop, as in the desert mountain ranges. The species has been taken from March to August in southern California.

Foodplants: Exclusively species of the dwarf mistletoe genus *Arceuthobium* (family Loranthaceae), which occur only on conifer host trees in the family Pinaceae. A full list of records appears in the excellent paper by Shields (1965) on *Mitoura spinetorum*.

Early stages (text fig. 47): The egg is the usual echinoid shape with a reticulation of raised walls over the surface. The mature larva has a yellow-olive ground color with a middorsal pale olive band. Subdorsally on most segments occurs an oblique off-white bar. The lower edges of these bars are tinged with dark magenta; above each bar is a large raised waxy orange patch (fifth to ninth segments). Only the abdomen bears short colorless hairs. The pupa is dark chestnut brown with heavy black mottling. Pupation occurs within the foodplant mass and no silken attachment was observed (Comstock & Dammers, 1938).

NELSON'S HAIRSTREAK

Mitoura nelsoni nelsoni (Boisduval)

Plate 6, figures 37-39

Nelson's Hairstreak is distributed through the higher mountains of southern California wherever Incense Cedar is common. Adults are often very abundant during June and July in such areas, and they are avid flower visitors. The crest of the Greenhorn Mountains in Kern County supports large *nelsoni* populations. Males are "territorial," perching on cedar trees and flying rapidly towards intrud-

ing neighbors, then returning to the same perch. The species is single brooded. Diapause occurs in the pupal stage. The darker, central coast subspecies, *M. nelsoni muiri* Hy. Edwards, is known from the Santa Lucia Range, two miles northwest of Cuesta Pass in San Luis Obispo County (early May, Langston); this southernmost record falls just north of our rather arbitrary line delineating southern California, and the butterfly may yet be found farther to the south.

Foodplant: Incense Cedar, *Libocedrus decurrens* Torr. (Cupressaceae).

Early stages (text fig. 47): The early stages of this butterfly very closely resemble those of *Mitoura siva juniperaria* Comstock and *M. loki* Skinner, and were described by Comstock and Dammers (1932). The echinoid egg is green. The mature larva is vivid green with darker green raised lobulations. A series of irregular lemon-yellow crescents occur on each side of the dorsal area. Minute brown hairs occur over the body. The pupa is blackish brown and covered with minute brown hairs. No silk girdle was noted.

THE SIVA HAIRSTREAK

Mitoura siva (Edwards)

This beautiful green hairstreak occurs in the juniper belt of our southern California mountains and desert ranges. It has subspeciated into at least four races, three being found in our area:

(a) THE SIVA HAIRSTREAK

Mitoura siva siva (Edwards)

Plate 6, figures 40-42

The typical subspecies of *Mitoura siva* occurs commonly from Colorado through New Mexico and Arizona, and penetrates our territory in the mountains of the eastern Mojave Desert. It flies in the pinyon-juniper zone of the Providence, New York, Clark, Kingston, and Panamint ranges, and will likely be found in the Old Woman and Argus mountains as well. The adults are best taken at nectar sources; *Eriodictyon* blossoms in the New York Mountains seem to be especially attractive. The flight period involves at least two broods, one in March to April and the other in June, with perhaps a fall brood after summer rains (necessary to produce nectar sources for emerging adults, even though the larval host is evergreen).

Foodplant: Utah Juniper, *Juniperus osteosperma* (Torr.) Little (Cupressaceae).

Early stages (no text fig.): Undescribed, despite the wide distribution of this subspecies in the west.

(b) THE JUNIPER HAIRSTREAK

Mitoura siva juniperaria Comstock

Plate 6, figures 43-45

In the spring in a juniper forest, the Juniper Hairstreak is often quite abundant but unless one taps the branches to scare up perched adults or finds a stand of blooming yellow composites (especially *Haplopappus linearifolius* DC.) where the butterflies are feeding, it will rarely be seen. *Mitoura siva juniperaria* is found along the western and southern borders of the Mojave Desert from the northeast end of the San Bernardino Mountains west to the Mt. Pinos region, then north to the Walker Pass area and west from there to the Bodfish region in Kern County. The exact northern and western limits of its range remain to be defined by future collecting. A blend zone with *M. s. mansfieldi* should be sought on the slopes of the Sierra Madre Mountains above the Cuyama River Valley in Santa Barbara County. Also, a zone of hybridization with *M. loki* may occur at the northeastern end of the San Bernardino Mountains.

The flight period of the first brood is from late March to May (closely correlated with the blooming

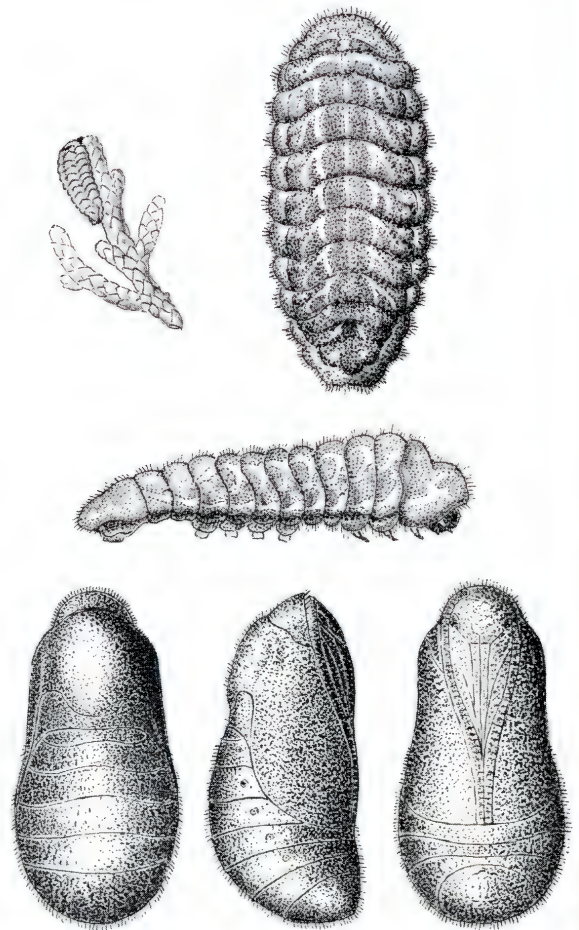


FIGURE 48. Mature larva and pupa: *Mitoura siva juniperaria*. (From Comstock, 1927.)

of *Haplopappus*) and that of the second brood is June to August.

Foodplant: California Juniper, *Juniperus californica* Carr. (Cupressaceae).

Early stages (text fig. 48): The early stages were described by Coolidge (1924) (incorrectly identified as "*M. loki*," although the life histories of the two species are essentially identical). The echinoid egg is green and has deep triangular reticulations. The mature larva resembles the small terminal twigs of the foodplant with incredible perfection. The ground color is green, with darker green raised areas and a series of irregular lemon-yellow crescents on either side of the middorsal area. Minute brown hairs cover the body. The pupa is dark chestnut brown and is covered with short hairs except on the wing cases and facial portions.

(c) MANSFIELD'S HAIRSTREAK

Mitoura siva mansfieldi Tilden

Plate 6, figure 46

The type locality of this extremely restricted central Californian subspecies is right on the border of our area: seven miles west (at 1900 ft elevation) of Simmler in San Luis Obispo County. *Mitoura siva mansfieldi* has been taken up to 30 mi W of this area at various points and at the road summit (3100 ft) crossing the Temblor Range (Sette, unpublished notes), as well as in several more northern populations. O.E. Sette has also noted that specimens from the upper Cuyama Valley northwest of Ojai in Ventura County seem transitional between *M. s. mansfieldi* and *M. s. juniperaria*. The flight period is recorded as solely late March to early April. Adults visit the flowers of Gold Fields (*Baeria* sp.).

Foodplant: *Juniperus californica* Carr. (Cupressaceae).

Early stages (no text fig.): Undescribed.

SKINNER'S HAIRSTREAK

Mitoura loki (Skinner)

Plate 6, figures 47-49

Skinner's Hairstreak is a rare species in collections, although it is rather common at times in its isolated populations. The species may be distinguished from *M. siva* by its continuous row of submarginal spots on the ventral hindwing surface and the presence of brown mottling across the inner half of the same wing. *Mitouri loki* is found in the Sheephole Mountains of the Mojave Desert, the higher mountains of Joshua Tree National Monument, and the east end of the San Bernardino Mountains (seven miles south of Lucerne Valley), south along the western edge of the Colorado Desert to Baja California. Good populations exist west

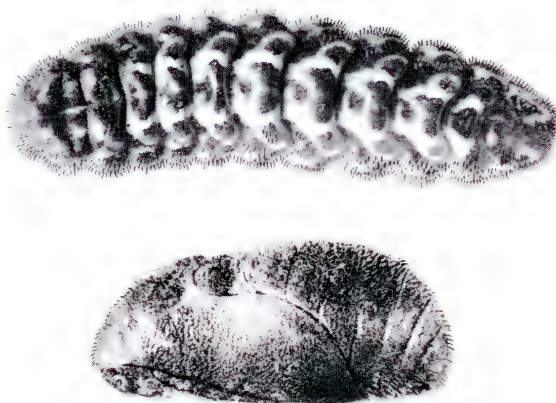


FIGURE 49. Mature larva and pupa: *Mitoura loki*. (From Comstock, 1932.)

of Jacumba in San Diego County. It extends toward the coast in the western part of Riverside County, such as in the Gavilan Hills, the south shore of Lake Mathews, and Pinyon Flat (above the desert). It flies in juniper habitats very similar to those of *M. siva juniperaria* to the north, and the two species may meet just south of Lucerne Valley (Sette, unpublished notes). The flight season from available records indicates two or occasionally three broods: March to April, late June and July, and occasionally again in mid November.

Foodplant: *Juniperus californica* Carr. (Cupressaceae).

Early stages (text fig. 49): The egg is a delicate light green, with raised portions of a lighter shade and with small structural difference from the egg of *M. siva juniperaria* (Comstock & Dammers, 1932). The egg stage lasts five days. The mature larva is vivid green with markings similar to those of *M. s. juniperaria*. The pupa is dark chestnut brown with fine mottling and a hairy coat except on the wing cases and facial portions. The life cycle passes in two months. The diapause stage is not known, since eggs as well as pupae hatch in a short time in laboratory rearings, but the insect is suspected to overwinter as a pupa.

THE WESTERN BANDED ELF

Incisalia eryphon (Boisduval)

Plate 6, figures 50-52

This beautifully banded hairstreak is a montane species, being restricted to the Transition and higher zones in the mountains of southern California, especially the Greenhorn and San Bernardino mountains. The males perch on small trees or shrubs along canyon bottoms or in clearings in the forest.

The flight period is late May to July. The species diapauses in the pupal stage.

Foodplant: Pines, *Pinus* species (Pinaceae); specific hosts in our area remain to be determined.

Early stages (no text fig.): The only published description is from populations on southern Vancouver Island far to the north of California (Hardy, 1959). There, the species uses Lodgepole Pine (*Pinus contorta*). The chalky white egg is a somewhat flattened sphere in shape. The mature (fourth instar) larva is sluglike and is a rich velvet green with paired subdorsal and spiracular cream stripes. Short brown hairs cover the larva. The pupa is a uniform dark brown and is secured by a cremaster and a silken girdle around the thorax.

THE WESTERN ELFIN

Incisalia augustinus iroides (Boisduval)

Plate 6, figures 53-55

This little brown elfin is one of the early spring butterflies of southern California and flies throughout the cismontane region. It is commonest in the chaparral, but occurs on the coastal plains as well as in the higher pine forests. The Western Elfin also flies in the ranges of the eastern Mojave Desert (e.g., the Providence Mountains) and these eastern populations resemble the subspecies *annetteae* dos Passos. The butterfly flies in a single brood from March to June, depending on elevation. At some low localities, early specimens can be taken in February.

Foodplants: The yellow vinelike parasitic plant, Dodder (*Cuscuta* species) (family Cuscutaceae) seems to be most extensively used in the chaparral. Powell (1968) lists the following additional hosts: *Ceanothus* species (Rhamnaceae), *Chlorogalum pomeridanum* (DC.) Kunth. (Liliaceae), and *Arbutus menziesii* (Ericaceae). Comstock's (1927) record of a *Sedum* species refers to a host of *Incisalia fotis windi* Clench in northern California, erroneously recorded for *iroides*.

Early stages (text fig. 50): The echinoid egg is a rich jade green and has features resembling the egg of a *Plebejus* blue more than a hairstreak (Comstock & Dammers, 1933). The first and second instars are yellowish green in ground color, with brown hairs. The mature fifth-instar larva is quite variable in color, with a ground color of olive, light green, or apple green (with yellowish bars). The olive type of larva is figured. The raised triangular area on each segment is bordered with a white band. White, red and mauve markings are placed in a subdued but complicated pattern. Minute brown hairs cover the larva. The pupa is pale brown, speckled with black on the head, thorax and wing cases. The abdomen



FIGURE 50. Mature larvae and pupae: *Incisalia augustinus iroides*—upper. Mature larva: *Callophrys dumetorum*—lower. (Paintings by C. M. Dammers.)

is bright chestnut, and bears seven longitudinal lines of dark blotches.

THE FOTIS HAIRSTREAK

Incisalia fotis fotis (Strecker)

Plate 6, figures 57, 58

The incredibly lovely softness of the Fotis Hairstreak's ventral coloration can be most appreciated when one has reared this rarity from eggs or larvae taken in the wild. In our area, it occurs only in the Providence, New York, Clark, Kingston, and Panamint mountains, above the seemingly barren stretches of the eastern Mojave Desert. Sparingly taken, it often flies in company with *Callophrys comstocki*, in canyons and washes where its foodplant, Cliff Rose (*Cowania*), grows. This plant closely resembles the Antelope Bush (*Purshia*) of the same areas, incidentally. The larvae are cryptically colored and blend well with the *Cowania* flowers and leaves. The adults fly from March to May, depending on latitude and elevation in this region (later to the north and at higher altitudes).

Foodplant: Cliffrose, *Cowania mexicana* var. *stansburiana* (Torr.) Jeps.

Early stages (no text fig.): Undescribed to date, although reared by several workers.

THE BRAMBLE HAIRSTREAK

Callophrys dumetorum dumetorum (Boisduval)

Plate 6, figures 59-61

The Bramble Hairstreak occurs throughout cismontane southern California in the chaparral and along the western edge of the Colorado Desert in San Diego and Riverside counties. It becomes abundant during the spring in canyons and on mountain slopes in the ranges of Kern County and the San Bernardino and San Gabriel mountains. It is also found on sand dunes near the coast in Santa Barbara and Los Angeles counties, but not in the deserts. A population occurs on Santa Cruz Island. The males frequently perch on protruding branches over washes and openings in the chaparral. The flight period involves a single brood from February to April.

Foodplants: *Lotus scoparius* (Nutt.) Otley (Leguminosae) and *Eriogonum fasciculatum* Benth. ssp. *fasciculatum*, ssp. *polifolium* (Benth.) S. Stokes, and ssp. *foliolosum* (Nutt.) S. Stokes (Polygonaceae).

Early stages (text fig. 50): The echinoid egg is deep green and is covered with a raised white network of walls. The variable larva is usually bright green with a rather faint yellow subdorsal line and a white lateral line. The cervical shield is a pale rose. The body is covered with minute brownish hairs. The pupa is deep brown with blackish blotches and short brown hairs arising from black papillae. Pupation occurs in leaf litter under the foodplant. Coolidge noted in his 1924 description of the life history that the females sometimes spent a half hour or more before selecting a suitable site for oviposition upon the sepals of unfolding *Lotus* buds.

COMSTOCK'S HAIRSTREAK

Callophrys comstocki Henne

Plate 6, figures 62, 63

This demure little species was described in 1940 and is still rare in collections. In California, its distribution is restricted to the Granite Mountains (north of Amboy), Providence Mountains, New York Mountains, Clark Mountain, Kingston Range, and the Panamint Mountains in the eastern Mojave Desert. For many years *Callophrys comstocki* was known only from the Providence Mountains, but explorations in the past decade have revealed its more extensive distribution. Some *Callophrys* populations north of the Death Valley region appear intermediate between *C. comstocki* and *C. leberti* Tilden, a Sierran species.

Comstock's Hairstreak is multiple brooded, although the second and third broods may be small or absent, depending on rainfall patterns. The first

brood flies in March-April, the second in June-July, and the fall brood in August-September. The summer and fall specimens have ventral coloration which is more yellow-green than that of the spring brood which is darker gray-green. The males are territorial in washes and often fly well below the suspected breeding areas high on the canyon slopes where *Eriogonum umbellatum* grows. Adults avidly visit flowers of *Rhus trilobata* in the desert canyons. The butterfly is generally uncommon and specimens are scarce in collections, but an occasional wet year results in large emergences, such as 1966, when one could take 40 or 50 in a day in Bonanza King Mine Canyon in the Providence range.

Foodplant: *Eriogonum umbellatum* Torr. ssp. *subaridum* (S. Stokes) Munz (Polygonaceae) is strongly suspected, as females are very closely associated with this plant in the wild. In captivity, females oviposit readily on *Eriogonum umbellatum* and the larvae can be reared on *Eriogonum latifolium* Sm.

Early stages (no text fig.): Generally similar to those of *C. dumetorum*, but undescribed in formal publications to date.

THE AROTA COPPER

Lycaena arota (Boisduval)

The Arota Copper occurs in scattered colonies throughout much of California, and in southern California it exhibits a particularly interesting cismontane distributional pattern:

(a) THE AROTA COPPER

Lycaena arota arota (Boisduval)

Plate 6, figures 65, 66

The typical form of the Arota Copper, *Lycaena arota arota* (Boisduval), is found in a curving "horseshoe" of populations skirting the Los Angeles basin. The butterfly occurs from throughout the Tehachapi Mountains (Kern County) east to widely scattered sites in the San Bernardino Mountains (San Bernardino County) and San Jacinto Mountains (Riverside County), then back southwest through the Santa Ana Mountains (Orange County). Here it approaches the extreme southern limit of its range, as the butterfly is very rare in San Diego County. The flight period is late May to July.

(b) THE CLOUDY COPPER

Lycaena arota nubila Comstock

Plate 6, figures 64, 67

In the Santa Monica Mountains of Los Angeles County *Lycaena arota nubila* ranges from above Malibu (e.g., Malibu Lake and Rustic Canyon) to Griffith Park (type locality) and into the Glendale region and to Mt. Wilson of the San Gabriel Mountains. Thus the range of this darker colored wider-marginal-band race represents a coastal enclave surrounded by the

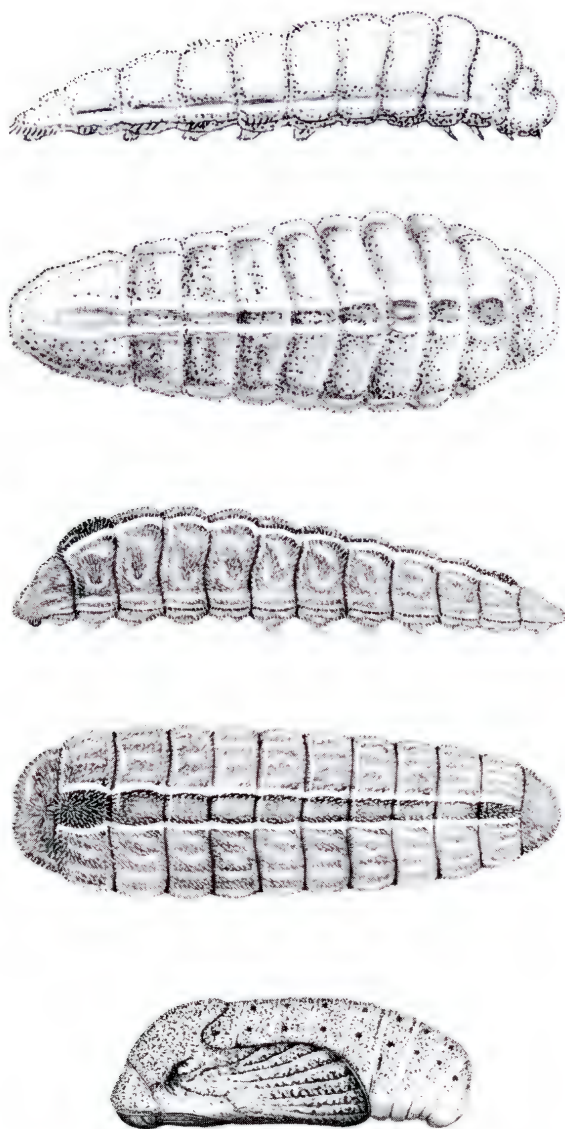


FIGURE 51. Mature larva (lateral and dorsal views): *Lycaena arota arota*—upper two figures. Mature larva (lateral and dorsal views) and pupa: *L. a. nubila*—lower three figures. (Paintings by J. A. Comstock.)

brighter, orange colored inland populations. The flight period is late May to July.

The males of both subspecies perch above clearings and exhibit territoriality.

Foodplants: Wild currant or gooseberries (*Ribes*). For *L. a. arota*: *Ribes californicum* H. & A. var. *hesperium* (McClat.) Jeps. and *R. roezlii* Regel. (Saxifragaceae), probably other *Ribes* species. For *L. a. nubila*: *Ribes aureum* Pursh var. *gracillimum* (Cov. & Britt.) Jeps. according to Comstock.

Early stages (text fig. 51): The turban-shaped egg is off-white in color and has about 14 heavy vertical

ribs with shallower cross-ribbing. The mature larva is slug-shaped and green in ground color, somewhat darker at the head end. The skin is covered with minute white granulations; minute yellowish white hairs arise from the skin surface, but not from these tubercles. A double white line occurs dorsally and there is a fine single yellowish lateral line. The larvae of both the typical race and *nubila* are shown in the accompanying figures. The variable pupa is brown or mottled yellow-brown. There are minute hairlike processes with flaring trumpet-shaped ends. The pupa is supported by a silk girdle around the thorax (Comstock, 1928).

THE HERMES COPPER

Lycaena hermes (Edwards)

Plate 7, figures 6-8

One of our most famous endemic butterflies, *Lycaena hermes* has an exceedingly restricted range. Its known distribution in the United States includes only part of San Diego County, extending 50 mi N of the Mexican border almost to the town of Fallbrook and east about 40 mi from the Pacific Ocean. It occurs south of the border almost 100 mi to a point 18 mi south of Santo Tomas in Baja California. Everywhere, the Hermes Copper colonies are closely confined to the vicinity of the host plant, *Rhamnus crocea* Nutt. However, some factor other than foodplant limits the range of the butterfly since *R. crocea* is found throughout the Coast Ranges in California. The use of a rhamnaceous plant by *hermes* is unique in the genus *Lycaena*, a presumably ancient worldwide genus of relatively few, phenotypically similar species.

The existing populations are quite stable from year to year, with no wide fluctuations in numbers. The flight period of the single brood peaks around June 20, with records extending from May 20 to July 20. Males are mildly territorial. Both sexes avidly visit flowers, especially of *Eriogonum fasciculatum*. Thorne (1963) has provided an excellent comprehensive summary of our knowledge of this species, including a map of known populations.

Foodplant: Red Berry, *Rhamnus crocea* Nutt. (Rhamnaceae).

Early stages (text fig. 52): The eggs are laid on the *Rhamnus* stems and overwinter until the following spring. The white, echinoid egg is covered with deep pits between high, irregular walls. The mature larva is apple-green, with a middorsal band of darker green bordered with yellowish green. On each side, there are two indistinct longitudinal bands, interrupted at each segmental suture. The body is sparingly covered with minute, silvery white, pillar-shaped stout projections with rounded ends. The head is soiled yellow. The cervical shield has a dis-

tinctive, double diamond-shape and is brown, bisected by a bluish white bar across the center. Pupation occurs on the foodplant; the pupa is supported by a delicate girdle and a cremaster attached to a silken pad. It is grass green, with a narrow mid-dorsal yellow stripe on the abdomen as well as other faint yellow diagonal bars. There are minute silvery white processes which resemble trumpet-shaped projections. Full details of the life history are described by Comstock and Dammers (1935b).

THE GORGON COPPER

Lycaena gorgon (Boisduval)

Plate 6, figure 68

Plate 7, figures 1, 2

The Gorgon Copper is relatively common over cismontane southern California from Kern to Orange counties. It prefers the canyon areas in the chaparral zone and avidly visits *Eriogonum* flowers. Though all the *Lycaena* exhibit sexual dimorphism to some degree, the male and female of *Lycaena gorgon* are markedly different in coloration and pattern. The single brood flies in May and June, with records in the northern Tehachapi Mountains extending to mid-July. Diapause is in the egg stage.

Foodplant: *Eriogonum elongatum* Benth. (Polygonaceae) in our area; members of the *E. nudum* Dougl. ex Benth. complex are the most common hosts in northern California.

Early stages (text fig. 52): The eggs are laid singly, or occasionally in pairs or threes, at the forks of the flowering stems of the host plant (Comstock & Dammers, 1934). The echinoid egg is extraordinarily deeply ribbed into surface "cells" and is a creamy white. The mature larva is a pale turquoise green, largely obscured by a dense covering of long white hairs. Overall, the whitish appearance is cryptic on the leaves of the foodplant. Pupation takes place on the foodplant in late May, using a silk girdle for support. The pupa is a pale blue green, with a slight yellowish shading on the abdomen. All surfaces but the wing cases are thickly studded with minute fungoid or trumpet-shaped white protrusions, although these are absent in four longitudinal rows of circular patches (appearing dark in the dorsal view).

THE GREAT COPPER

Lycaena xanthoides xanthoides (Boisduval)

Plate 7, figures 3-5

This large, dull-colored copper ranges over cismontane southern California, generally in the foothills. It is commonly taken in association with its *Rumex* foodplants. From Kern County to the lowlands of San Diego County (e.g., Mission Gorge) the butterfly is on the wing in a single brood from May or June to mid-July, depending on elevation. The species overwinters in the egg stage. There seems to be little consistent color distinction

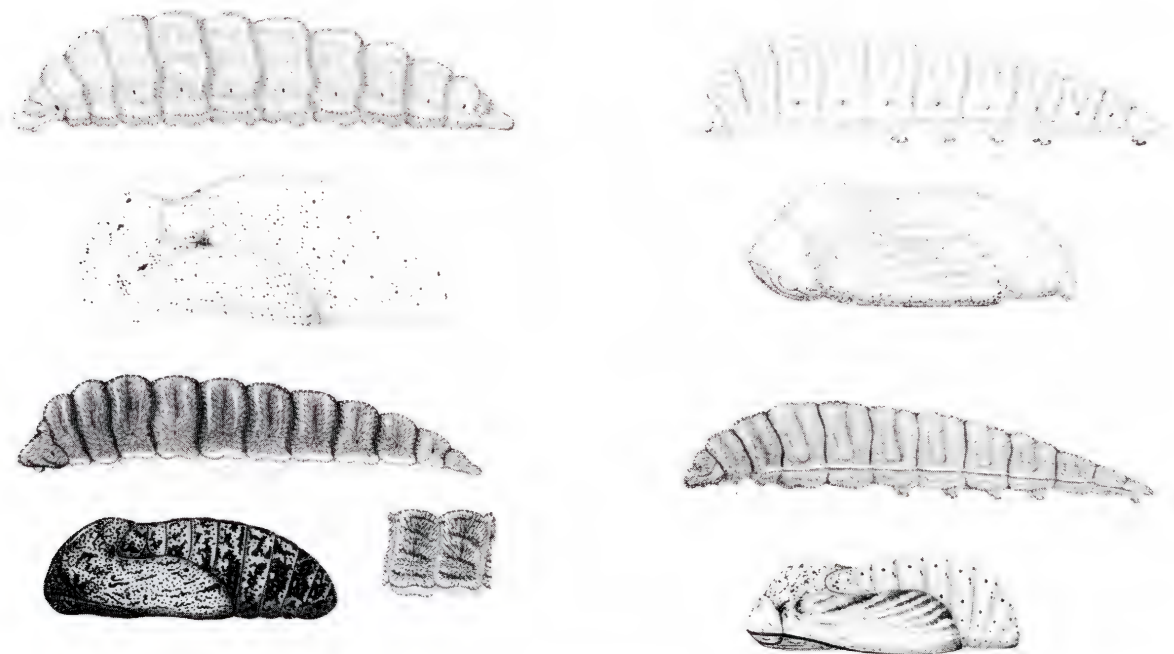


FIGURE 52. Mature larvae and pupae: *Lycaena hermes*—upper left; *L. gorgon*—upper right; *L. x. xanthoides*—lower left; *L. helloides*—lower right. (Paintings by C. M. Dammers.)

between typical *L. x. xanthoides* Boisduval and *luc-tuosa* named from southern California, and we consider them synonymous.

Foodplant: Dock, *Rumex* species (Polygonaceae); *R. hymenosepalus* Torr. according to Dammers (unpublished) and probably also *R. pulcher* L., a foodplant which is used in the San Francisco Bay area.

Early stages (text fig. 52): The eggs are laid singly on sticks, dead leaves, and debris at the base of the larval foodplant in June. The egg is echinoid with rather small pits between irregular walls. The color is at first a pale green, later changing to white as the egg matures. The larval instars are described in detail by Comstock and Dammers (1935c). When not feeding, they rest near the base of the plant among litter or dead leaves. The mature larvae are polymorphic, there being an apple-green morph, a yellowish green form, and a dark orange form bearing bands and bars of magenta! The cervical shield is green, with slight mauve shading around its margins. A narrow bluish white bar bisects this shield, and the whole is sparsely white punctate. Very surprisingly, Comstock and Dammers found that when the larva prepares to pupate, it forms "a loosely woven silk cocoon on the floor of the breeding cage, into which it incorporated particles of soil. This cocoon formation by a lycaenid is a most unusual feature, and the first of its kind encountered in our breeding of diurnals." The pupa is pink buff in color and is spotted and blotched everywhere with irregular black markings. The surface is covered with minute colorless hairs except on the wing cases.

THE PURPLISH COPPER

Lycaena helloides (Boisduval)

Plate 7, figures 9-11

The Purplish Copper is widely distributed through the western two-thirds of the United States and is abundant in the lowlands and middle elevations (up to 5000 ft) of cismontane southern California. It particularly delights in moist or wet mountain meadows. Many of the seasonally wet lowland areas in Los Angeles, Orange, Riverside, and San Diego counties, where *Lycaena helloides* used to be abundant, have been destroyed by housing projects. The butterfly is multiple brooded and flies from April to October.

Foodplant: *Rumex* species (Polygonaceae); the species used in our area remain to be identified.

Early stages (text fig. 52): The echinoid egg is somewhat more flattened than the others in the genus and especially differs in the less extreme reticulation and presence of nodules instead of thin high walls and deep cells. The mature larva is grass green and has a bright yellow lateral stripe as well

as a broken bright yellow line on each side of the middorsal region. A faint yellow oblique dash occurs on the side of each segment. The body hairs are colorless and somewhat longer than those of other *Lycaena* species. The pupa is greenish, with brown and black markings, and has numerous pale green low warty tubercles, bearing bristles.

THE BRIGHT BLUE COPPER

Lycaena heteronea clara Hy. Edwards

Plate 7, figures 12-14

The Bright Blue Copper is the southern race of a Sierran and Great Basin species which is extraordinary for having a brilliant blue color in the males instead of the usual coppery tone. It occurs in scattered colonies only in montane meadows in the Tehachapi Mountains across the Fort Tejon area to Mt. Pinos. The males frequently perch on sagebrush, *Artemisia tridentata*, and hold "territories." The females stay close to the suspected *Eriogonum* buckwheat foodplant. The subspecies is generally scarce and very local, hence rarely represented in collections. It flies in late June to early August.

Foodplant: Suspected to be an *Eriogonum nudum* subspecies (Polygonaceae), but this has not yet been confirmed.

Early stages (no text fig.): Described only for the typical Sierra Nevada subspecies by several authors (Williams, 1910; Comstock, 1927b). The species overwinters in the egg stage.

THE MARINE BLUE

Leptotes marina (Reakirt)

Plate 7, figures 17-19

The Marine Blue is found throughout the lowlands of southern California, including the deserts and the islands of Santa Catalina and Santa Cruz. It becomes more uncommon at middle elevations in the mountains, although it has been taken as high as 6050 ft on Aguerreberry Peak in the Panamint Mountains. In our parks and suburban areas, it often flies abundantly due to the extensive plantings of *Plumbago* perennials as ornamentals. While *Leptotes marina* is multiple brooded and has been regularly recorded in Los Angeles as a breeding resident in every month of the year, the main flight period in our region is March to October, with a peak from July into the fall.

Foodplants: Leadwort, *Plumbago* (Plumbaginaceae) in urban areas; elsewhere, a variety of Leguminosae are used, e.g., alfalfa (*Medicago*), pea (*Lathyrus*), sweet pea, and *Astragalus* species. Chris Henne has found the butterfly using *Amorpha californica* Nutt. (False Indigo; Leguminosae) in Lone Pine Canyon at the east end of the San Gabriel Mountains.

Early stages (text fig. 53): The turban-shaped egg is a delicate green color with a raised whitish network. The mature larva is exceedingly variable in color and pattern, with every intergrade between almost pure light green to a rich brown with heavy chocolate colored bands and diagonal stripes. The genetics of this color and pattern variability would be an exceptionally interesting study. The pupa is pale ochre-brown, with pale gray wing cases and spots of dark brown. It is suspended by a silken girdle and bears short hairs over the surface.

THE PIGMY BLUE

Brephidium exilis (Boisduval)

Plate 7, figures 15, 16

This tiny blue occurs in abundance in the lowlands and deserts of southern California, but its small size and weak flight attract little attention. The Pigmy Blue has been found on Santa Catalina and Santa Cruz islands, at Furnace Creek Ranch in Death Valley at 178 ft below sea level, and on Aguerreberry Peak (6050 ft above sea level) in the Panamint Mountains. It is rarely encountered in the higher elevations of our area. The multiple broods fly in every month of the year in at least Los Angeles and San Diego counties, and from late March to October elsewhere.

Foodplant: *Chenopodium* (Pigweed) and *Atriplex* (Saltbush) species (family Chenopodiaceae), espe-

cially *Atriplex semibaccata* R. Br., (Australian Saltbush), an introduced plant which is abundant in waste places in southern California. Henne has found larvae on *Atriplex hymenelytra* Wats. at Red Rock Canyon in Kern County. Comstock (1927a) records also *Petunia parviflora* Juss. (Solanaceae) as a host.

Early stages (text fig. 53): The turban-shaped egg is delicate bluish green with a raised white network. The mature larva is yellowish green and is covered with brownish tubercles bearing minute white processes. It usually bears a yellowish white dorsal line and a bright yellow narrow lateral band. The pupa is variable in color, but is usually light yellowish brown with scattered brown dots. Minute hairs are present on the abdomen and a few other points.

EDWARD'S BLUE

Hemiargus ceraunus gyas (Edwards)

Plate 7, figures 20-22

Edward's Blue occurs in the deserts and lowlands of southern California, generally away from the coast. It is rarely taken in the mountains. The flight period extends from late March to October, with the late summer and fall broods being more abundant.

Foodplants: *Prosopis* (mesquite) and *Medicago* (alfalfa), both in the Leguminosae (Comstock & Dammers, 1934).

Early stages (text fig. 53): Described by Comstock

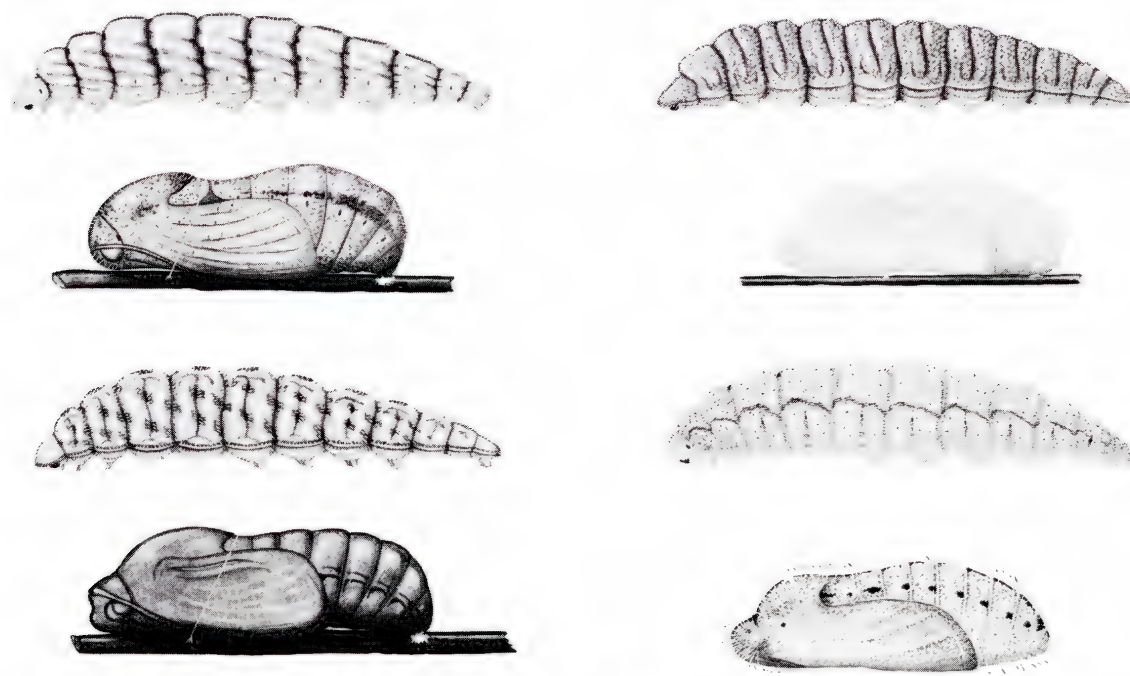


FIGURE 53. Mature larvae and pupae: *Leptotes marina*—upper left; *Brephidium exilis*—upper right; *Hemiargus ceraunus gyas*—lower left; *Everes amyntula*—lower right. (Paintings by C. M. Dammers.)

& Dammers (1934). The delicate light green egg is turban-shaped with a depressed top. The surface is covered with small stout nodules, arranged in more or less regular diagonal lines, as with *Brephidium exilis*. The mature larvae (only 0.8 mm in length) vary widely in body color and pattern. Some are a solid pale green, others show green with a mauve subspiracular fold. Still others have a mauve mid-dorsal band added to the last described combination. In others, the body is deep green, light yellow, or even dark yellow. Many of the forms bear two darker diagonal bands of green laterally on each segment. The entire body is covered with short silvery white hairs. The larvae feed on the tips of the young host shoots. Pupation occurs on the food-plant, using a fine silken girdle. The pupa is bright translucent green, with a dark middorsal line.

REAKIRT'S BLUE

Hemiargus isola alce (Edwards)

Plate 7, figures 23-25

This butterfly very closely resembles *Hemiargus ceraunus gyas*, but it may be readily distinguished on the underside by the presence of a row of black spots, circled with white, on the forewings. It is a western race of the widespread species *Hemiargus isola* Reakirt. Reakirt's Blue flies throughout southern California, including the desert mountain ranges, but it is scarce and sporadic in the more coastal and higher mountains. For unknown reasons, this butterfly occasionally appears in unusual localities and habitats in certain years, then is absent from these areas for long periods. Such a phenomenon occurred in 1958 when the authors took the species fairly commonly above timberline in the arctic-alpine zone above Thousand Island Lake in the Sierra Nevada! The species could not survive the winters there. The flight period in southern California is April to October.

Foodplants: These remain to be discovered in our area. Elsewhere, the species feeds on *Prosopis* (mesquite) (Leguminosae), according to Ehrlich and Ehrlich (1961).

Early stages (no text fig.): Undescribed.

THE WESTERN TAILED BLUE

Everes amyntula (Boisduval)

Plate 7, figures 26-28

This bright blue, tailed species is found throughout the mountains and moister lowlands of southern California, although not in the deserts. It also occurs on San Miguel, Anacapa, and Santa Catalina islands. The Western Tailed Blue becomes moderately common in May and June, with two broods flying in the lowlands (March to the end of August).

The Eastern Tailed Blue, *Everes comyntas*

Godart, may enter our area along the east slope of the southern Sierra Nevada in Kern County, or from the southern portion of the San Joaquin Valley, or possibly in the ranges of the eastern Mojave Desert. Further to the north in California, *E. comyntas* occupies similarly distinct habitats from those of *E. amyntula*, that is, generally on valley floors in semiarid areas such as the Delta region east of San Francisco Bay, the San Joaquin Valley, and the Owens Valley. Its flight period is April to September. While the resemblance to *E. amyntula* is close, *E. comyntas* has smaller and fewer black dots on the ventral surface of the wings; we consider the two species to be distinct, and not one species (*comyntas*) as proposed by recent authors.

Foodplants: *Astragalus* species (Leguminosae). Careful identifications of specific hosts remain to be made.

Early stages (text fig. 53): The echinoid eggs are pale green and are deposited singly on the flowers or young seed pods of the host. The mature larva is highly variable, ranging from a greenish straw color with pink and maroon markings, through a yellowish green with pale mauve markings, to a solid green, with darker middorsal line. The entire body surface is covered with short fine white hairs arising from minute black punctae of various sizes. The species overwinters as nearly full-grown larvae, generally remaining in the *Astragalus* pods where they have been feeding on the young seeds. The pupa is pale soiled buff, occasionally greenish gray or olive-white, with a dark brown dorsal band and blotches. Long white hairs are scattered over the surface.

THE GREENISH BLUE

Plebejus saepiolus (Boisduval)

Plate 7, figures 29-31

Two restricted subspecies of this widely distributed western blue occur in our area. The Greenish Blue, *Plebejus saepiolus saepiolus* (Boisduval), is abundant in mid-summer in the Sierras and barely enters our area in the high wet meadows of the Greenhorn Mountains in Kern County. The Hilda Blue, *Plebejus saepiolus hilda* (Grinnell and Grinnell), is found in wet meadows above 5000 ft on Palomar Mountain, and in the San Jacinto, San Bernardino and San Gabriel mountains. Both subspecies fly in June and July. Populations are generally rather local, but the butterfly is often the most abundant blue where it occurs. The Hilda Blue is distinguished from the typical subspecies by the brighter blue of the males, the distinct and extensive orange band on hind- and forewings in the female, and the larger spots on the clear bluish white ventral surface.

Foodplants: Clovers, including (for *P. s. hilda*) *Trifolium wormskioldii* Lehm., *T. monanthum* Gray, and *T. longipes* Nutt. var. *atrorubens* (Greene) Jeps. (Leguminosae).

Early stages (no text fig.): Not described to date, although reared. The species diapauses as half-grown larvae.

BOISDUVAL'S BLUE

Plebejus icarioides (Boisduval)

This very variable blue is distributed throughout western North America wherever lupines grow. Three subspecies occur in our area:

(a) THE EVIUS BLUE

Plebejus icarioides evius (Boisduval)

Plate 7, figures 32-34

This butterfly is found generally in the mountains of southern California outside the deserts. Transition Zone habitats are preferred. It is especially abundant in the Tehachapi Mountains. The females show a great deal of variation. Adults fly in a single brood from May to July.

(b) THE MORO BLUE

Plebejus icarioides moroensis (Sternitzky)

Plate 7, figures 35-37

The Moro Blue flies only along the immediate coast in San Luis Obispo and western Santa Barbara counties. It may once have occurred on the sand dunes in western Los Angeles County, although only several old specimens survive in collections to suggest a former abundance. This distinctive subspecies may soon become extinct in its present range as increasing development and use of "dune-buggies" destroy the butterfly's sand dune habitats. The dune vegetation is literally being torn to shreds by these vehicles and even collecting in these areas has become dangerous due to the dune-buggy traffic. The type locality at Morro Bay has been greatly disturbed, in part, by the nuclear power plant there. The strongest remaining population seems to be at Oso Flaco dunes in San Luis Obispo County. The flight period is April to June, with the males appearing first.

(c) *Plebejus icarioides* subspecies

Plate 7, figures 38-40

A third unnamed subspecies flies in the Argus and Panamint mountains in April and May, associated with *Lupinus excubitus* Jones (Leguminosae). It is a small, pale race with "washed-out" markings on the ventral surface.

Foodplants: For *P. i. evius*, *Lupinus densiflorus* var. *glareosus* (Elmer) C. P. Sm. (Leguminosae) at Frazier Park and probably other species elsewhere. For *P. i. moroensis*, *Lupinus chamissonis* Eschs. is the suspected host in its sand-dune habitat.

Early stages (text fig. 54): Described only for *P. i. evius* in our area (Comstock and Dammers, 1935a). The echinoid eggs are a delicate greenish white and are covered with projecting white papillae. They are laid singly on the foodplant and hatch in five to eight days. The mature larva is green with three indistinct white diagonal bars on the sides of each segment. The body is covered with very short white hairs. They feed for about a month, first on leaves and then on flowers, and then go into hibernation as half-grown larvae until the following spring. Pupation occurs at the base of the foodplant, using a silk button and girdle. The pupa is green on the wing cases, head, and thorax, and a chestnut red with blotches of green on the abdomen. Short chestnut red hairs are scattered over the surface except on the wing cases. The pupal stage lasts about three weeks.

THE ACMON BLUE

Plebejus acmon acmon (Westwood & Hewitson)

Plate 7, figures 41-46

The Acmon Blue is generally distributed throughout southern California from sea level to 10,000 ft, although it is scarcer at higher elevations and in the drier regions of the Colorado desert. A low density population has been found by Langston on Santa Cruz Island. The species also occurs on Santa Catalina Island. Considerable seasonal variation is characteristic, with the early spring females having extensive blue scaling (form "cottlei") and the summer females being concolorous brown. The flight period of this multiple brooded species extends from February to October.

In the eastern Mojave Desert (e.g., the Providence Mountains), *Plebejus acmon texanus* Goodpasture is sparingly found in the late spring. The main range of this recently described subspecies is southern Nevada, Arizona, New Mexico, and Texas.

Foodplants: *Astragalus* and *Lotus* species, especially *L. scoparius* (Nutt.) Ottley (Leguminosae), the primary host in southern California; buckwheats, *Eriogonum* species (Polygonaceae), are used extensively, also.

Early stages (text fig. 54): The echinoid egg is a delicate pale green. The mature larva is soiled yellow with variable lateral markings, and is covered with short downy white hairs. The narrow dorsal stripe is greenish. The pupa is greenish on the abdomen and brown elsewhere.

THE LUPINE BLUE

Plebejus lupini monticola (Clemence)

Plate 7, figures 47, 48

The Lupine Blue is a characteristic inhabitant of chaparral communities of the Coast Ranges from

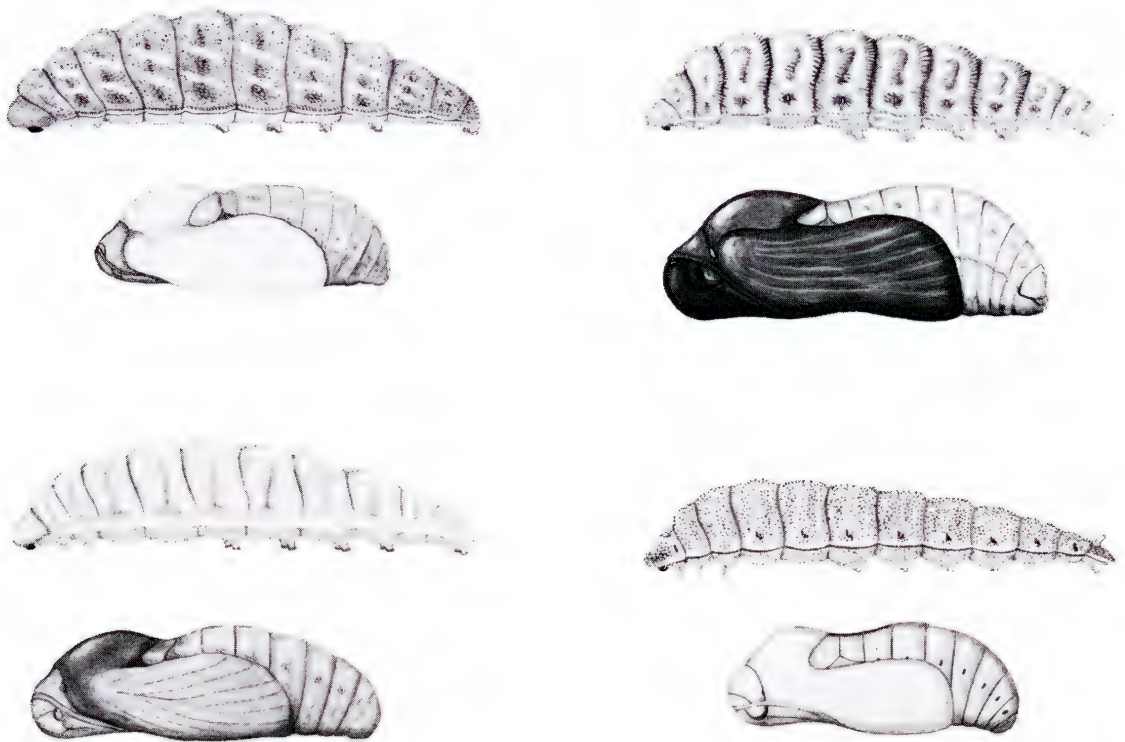


FIGURE 54. Mature larvae and pupae: *Plebejus icarioides evius*—upper left; *P. a. acmon*—upper right; *P. neurona*—lower left; *P. emigdionis*—lower right. (Paintings by C. M. Dammers.)

San Luis Obispo to San Diego counties and occurs through the Tehachapi and Greenhorn mountains, San Gabriel, San Bernardino, and San Jacinto mountains to about 6000 ft. Specimens are also known from the Panamint, Kingston, Clark, New York, and Providence mountains of the eastern Mojave Desert. In the Tehachapi and Tejon ranges, one finds some populations lacking the cyanic blue color and having a distinctly green cast (form "chlorina"). Goodpasture (*in prep.*) has recently demonstrated the distinct specific identities of *P. acmon* and *P. lupini*. Both species may be taken in the same areas. The flight period for *P. lupini* is May to July.

Foodplants: *Eriogonum* species (Polygonaceae) only, principally *E. fasciculatum* varieties; a subspecies of *E. umbellatum* Torr. is used by the eastern Mojave Desert populations.

Early stages (no text fig.): Not illustrated or described in detail in publications.

THE VEINED BLUE

Plebejus neurona (Skinner)

Plate 7, figures 52-54

This rare, orange-veined blue is particularly remarkable because of the rich dark brown ground

coloration present on the uppersides of both sexes. Scattered populations of *Plebejus neurona* occur at high elevations from the southern Sierra Nevada to the Tehachapi Mountains and Mt. Pinos region, and east along the San Gabriel and San Bernardino mountains. The species is apparently double brooded in at least the Frazier Park area of Kern County and at the base of Sugar Loaf Mt. in San Bernardino County, and flies from May to mid-August. The altitudinal distribution extends from 4000 to 8000 ft above sea level (latter limit reached on Sugarloaf Peak in the San Bernardino Mountains and on Mt. Pinos in Kern County. The butterflies may be taken in fair numbers on the summit of Mt. Pinos and at Frazier Park if the weather is warm and no wind is blowing. The adults stay very close to the ground, flying over their foodplants which grow prostrate in mats.

Foodplants: *Eriogonum wrightii* Torr. ex Benth. var. *subscaposum* Wats. and var. *trachygonum* (Torr.) S. Stokes. (Polygonaceae).

Early stages (text fig. 54): The echinoid egg is a delicate grayish green and is covered with a fine whitish reticulation of low raised walls. Eggs hatch in about nine days (Comstock & Dammers, 1933). The mature larva has an apple green body surface,

with profuse white hairs giving the suggestion of a gray overcast. There are broad white diagonal lateral bands on the segments, and a faint dark mid-dorsal line. The larva does not taper anteriorly and posteriorly to the same extent as with most other species in this group. Pupation occurs on the foodplant (after about 40 days in the laboratory). A silk girdle and silk button for the cremasteric attachment are used. The front of the pupa is vivid green, with a yellow-green abdomen and bluish gray wing cases. The body is almost free of hairs. Adults emerge for the second brood nine days after pupation. The stage in which overwintering occurs is unknown.

THE SAN EMIGDIO BLUE

Plebejus emigdionis (Grinnell)

Plate 7, figures 49-51

The San Emigdio Blue is a rare and local butterfly whose distribution and flight periods are poorly known by most collectors. The classic localities for the species are along the Mojave River near Victorville, but isolated colonies are scattered to the lower portion of Owens Valley, to northern Ventura County, and to Bouquet and Mint canyons in Los Angeles County. Several generations occur per year. The first brood flies in late April to May, the second brood in late June and early July, and the third brood in August to early September. The size of the summer broods may depend on summer rainfall. The butterfly was formerly thought to be single brooded.

The limited known distribution is puzzling in view of the fact that the foodplant is widespread throughout the western United States. Adults generally remain quite close to the foodplant. Tapping the plants while collecting will often stir up resting adults.

Foodplant: Saltbush, *Atriplex canescens* (Pursh) Nutt. (Chenopodiaceae).

Early stages (text fig. 54): The echinoid eggs are deposited singly on the leaves of the host and hatch in 8 to 10 days (Comstock and Dammers, 1932). The mature larva is extremely variable in color and ranges from a greenish through blue-green and gray, to a brown. All color morphs are spotted and blotched with black, and have short white hairs over the body. On the 11th segment are large retractile glands that are protruded when the larva is touched. It is speculated that these organs are attractive to ants. Diapause normally occurs in a late larval instar. The pupa is apple green or a straw color. It is usually attached to the foodplant by a silk button and girdle.

THE ORANGE-MARGINED BLUE

Plebejus melissa inyoensis (Gunder)

Plate 7, figures 55-58

The Orange-Margined Blue in our area has gone under several different names, including *P. m. lotis* Lintner and *P. argyrognomon lotis* Lintner. However, *P. argyrognomon lotis* is restricted to peat bogs and wet meadow habitats along the coast of northern California. *P. m. inyoensis* was named from a *P. melissa* population in eastern California and is the best available name for our southern California material. Adults from San Diego and Riverside counties in particular are not typical *inyoensis* and may represent a distinct subspecies.

In southern California, the Orange-Margined Blue is abundant in the Tehachapi Mountains and Mt. Pinos area of Kern and Ventura counties. It also flies at Pinyon Flat in Riverside County, on Mt. Palomar and near Lakeside, Warner's Springs, and other localities in San Diego County. The populations in the northern areas are apparently single brooded, flying from mid-May to mid-July (one record in late August). In San Diego County, records extend from late May to early October, probably representing at least two broods.

Foodplants: Wild Licorice, *Glycyrrhiza lepidota* Pursh. (Leguminosae) has been observed (Comstock, 1929) as a definite foodplant in our area. The adults are associated with *Lupinus* in Ventura and Kern counties. Larvae can be reared in the lab on *Wisteria*. There are older literature reports on other legumes such as *Astragalus* being used.

Early stages (text fig. 55): Comstock (1929) notes that "The female of this species spends a lot

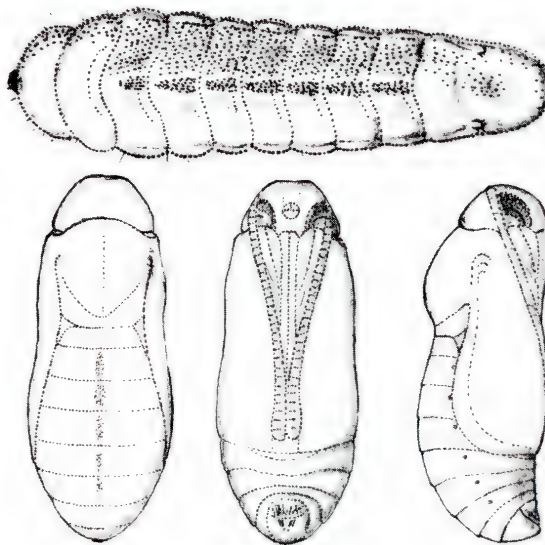


FIGURE 55. Larva and pupa: *Plebejus melissa inyoensis*. (From Comstock, 1929.)

of time in a pretense of laying—walking up and down the plant, and even on the ground at its base, before ovipositing. Though she seems very particular about choosing a site, the eggs may finally be laid on any portion of the plant, or even on dead leaves, sticks, or pebbles in proximity to it.” The egg, larva and pupa are similar to those of *P. emigdionis*, according to Comstock.

THE SQUARE-SPOTTED BLUE

Philotes battoides (Behr)

This attractive little blue has diverged into a number of races throughout the west, especially in California. Langston (1969a) has given an excellent review of the species and subspecies of *Philotes*, and his data are quoted here as well as in the other species accounts. Brown (1972) proposes in a brief note that our *Philotes* (except for *P. sonorensis*) are congeneric with the European *Pseudophilotes baton*. We continue to use *Philotes* until the current comprehensive review of the Nearctic species is published by Shields. Most of the Sierran populations represent typical *Philotes battoides battoides*. In southern California, we have approximately five distinctive groups of populations; two of these have been named and the others are presently under taxonomic study by Shields. These butterflies are often extremely close in phenotype to sympatric *Philotes enoptes* subspecies.

(a) THE BERNARDINO BLUE

Philotes battoides bernardino Barnes & McDunnough

Plate 7, figures 59-61

This small southern race occurs in the Upper Sonoran and Transition Zones throughout cismon-tane southern California, from the Coast Ranges of central California through the Sierra Madre, much of the Tehachapi, Santa Monica, San Gabriel, San Bernardino, and San Jacinto mountains, south to Tecate Peak in San Diego County and Baja California. The farthest east that “typical” *bernardino* penetrates is one mile west of Cottonwood Springs, Joshua Tree National Monument (Langston record). The flight period of the single brood is late May to early July. The adults become exceedingly abundant on *Eriogonum fasciculatum* bushes (Buckwheat) when they come into bloom. The larvae are cryptically colored and closely match the *Eriogonum* flowers. Diapause is in the pupal stage.

Foodplants: *Eriogonum fasciculatum* Benth. ssp. *fasciculatum* Benth., ssp. *polifolium* (Benth.) S. Stokes, and ssp. *foliolosum* (Nutt.) S. Stokes (Polygonaceae).

Early stages (text fig. 56): Described in detail from Lee Lake, Riverside County, material by Comstock and Dammers (1934). The echinoid-

shaped, bluish white eggs are laid singly on the flowers of *Eriogonum*, and the larvae feed exclusively on the blossoms. The mature larvae are exceedingly variable in color and pattern, ranging from a uniform pale blue-green, through green with chocolate markings, lemon yellow with chocolate, pale soiled yellow, to a uniform pink. Perhaps this great variability is selectively advantageous in matching the variable color changes that the host flowers progress through, and in preventing a predator from “fixing” his larval search image for a particular color morph. The figured larva is the form with pale green body color and rich chocolate pattern. The entire larva, except the head, is covered with fine short, silvery white hairs. Pupation takes place in late July, apparently without any silken attachment, in the desiccating blossoms of the *Eriogonum*. The pupa is pale chestnut with a slight suggestion of green on the wing cases. There are no hairs on any portion of the pupa.

(b) MARTIN'S PHILOTES

Philotes battoides martini Mattoni

Plate 8, figures 4-6

This butterfly is a denizen of the mountains of the eastern central Mojave Desert, including the Panamint Mountains (Inyo County), Providence, New York, Old Woman and Sheephole mountains (San Bernardino County), and as far west as the El Paso Mountains in Kern County. The flight period of the single brood is late April to early June. It is common in season but is not frequently collected since collectors do not venture into its territory in May (too late for most spring species of the deserts). The El Paso Mountains population is especially interesting since it uses the same host (*Eriogonum nudum*) which is generally used by *Philotes enoptes* subspecies.

Foodplants: *Eriogonum fasciculatum* Benth. ssp. *polifolium* (Benth.) S. Stokes in most areas; *E. nudum* Dougl. ex Benth, ssp. nr. *pubiflorum* Benth. is used in the El Paso Mountains (both Polygonaceae).

Early stages (no text fig.): Undescribed.

(c) *Philotes battoides* subspecies

Plate 8, figures 1-3

On the immediate coast of Los Angeles County, an undescribed subspecies of *battoides* flies in July and August. It uses *Eriogonum parvifolium* Sm. in Rees (Polygonaceae) as a host. Populations still exist on the El Segundo sand dunes at the western end of the runways of the Los Angeles International Airport, and in a few limited localities along the coast in the Palos Verdes area. The butterfly will probably become extinct unless some sort of action is taken to preserve the habitat areas.

(d) *Philotes battoides* subspecies

Plate 8, figure 7

In the Providence, New York, and Clark mountains of the far eastern Mojave Desert, an undescribed morph of *battoides* has been recently discovered by O. Shields and J. Emmel. It flies in September and October, and apparently utilizes *Eriogonum heermannii* Dur. & Hilg. (Polygonaceae) as a host. The flight is extremely rapid and the butterflies are difficult to capture and generally scarce. The butterfly is extraordinary in that it flies in some of the same localities where *P. b. martini* flies earlier in the year, yet the phenotype is completely different. The life history is not known. There is the possibility that these are adults from *P. b. martini* pupae occasionally brought out of diapause by late summer rains, but this seems unlikely since the habits are different and the distribution of the adults is strictly limited to the extent of the suspected *Eriogonum heermannii* foodplants, which bloom only in the fall. It is more probable that we are observing here a case of sympatric speciation, where pupae of the spring-flying *P. b. martini* have emerged in the fall on occasion in the past and these fall adults then found this fall-blooming *Eriogonum* on which to lay eggs. They had suddenly entered an unoccupied niche and selection would favor continued seasonal isolation and the development of a fall-breeding insect. Today we may be observing an intermediate stage of the speciation process, where the fall butterfly still resembles the spring-flying *P. battoides martini* in genitalic characters but is distinct biologically and in wing phenotype. Whether to call this a new species yet is a moot point. The spring and fall insects, however, cannot be called true geographic subspecies.

(e) *Philotes battoides* subspecies

Plate 8, figures 8, 9

A unique *battoides* subspecies is known only

from a series of specimens in the Natural History Museum of Los Angeles County collected in the Tehachapi Mountains (July 22, 1918) by Comstock. Its present status and possible extent of distribution are unknown. It closely resembles *P. enoptes enoptes*.

THE ENOPTES BLUE

Philotes enoptes (Boisduval)

Several races of this widespread western species fly in southern California, and often are separated from sympatric *Philotes battoides* populations only by different flight periods (spring versus late summer). The two species are frequently difficult to distinguish phenotypically and the specialist generally uses differences in the male genitalia.

(a) DAMMER'S BLUE

Philotes enoptes dammersi Comstock & Henne

Plate 8, figures 10-12

This fall-flying subspecies is found through the Mojave and Colorado Deserts. The type locality is Snow Creek, west of Palm Springs, in Riverside County. It is recorded by Langston and other lepidopterists from the San Geronio Pass area east to the Granite, New York, Kingston, and Clark mountains of San Bernardino County, south to San Diego County locales such as Yaqui Wells in Anza Desert, Laguna Junction, Boiling Spring and Camp Ole in the Laguna Mountains. It flies from the end of August to mid-October, and can be taken in fair abundance on its blooming host plants.

Foodplants: *Eriogonum elongatum* Benth., *E. wrightii* Torr. ex. Benth. ssp. *trachygonum* (Torr.) S. Stokes (Polygonaceae).

Early stages (text fig. 56): Described by Comstock and Henne (1965). The echinoid egg is light blue-green and the top is deeply depressed. The eggs are laid singly in the buds of blossoms of the host, and larval feeding is confined exclusively to the flower. The mature larva is ivory white, with tinges of pink.



FIGURE 56. Mature larvae and pupae: *Philotes battoides bernardino*—left; *P. enoptes dammersi*—right. (Paintings by C. M. Dammers.)

The middorsal stripe is pinkish brown, the diagonal lateral markings brown, and the low lateral line pinkish. Blotches of pink occur on each segment between this line and the more dorsal slashes. The larva is completely covered by short white hairs, giving the larva a frosted appearance. The pupa is uniform pale chestnut and lacks hairs. It is supported by a silk girdle and a caudal silk button.

(b) TILDEN'S BLUE

Philotes enoptes tildeni Langston

Not figured

A central Californian subspecies, *P. e. tildeni* is a late-season flier found along the Inner Coast Range as far south as eight miles west of Simmler and Cottonwood Pass (6 mi NE Cholame) in San Luis Obispo County, barely reaching southern California as defined here.

Foodplants: *Eriogonum nudum* Dougl. ex Benth. ssp. *indictum* and ssp. *saxicola* (Heller) S. Stokes (Polygonaceae).

Early stages (no text figs.): Undescribed.

(c) There are four other unnamed groups of populations that seem distinct to current workers. These are found at: (1) Big Rock Creek and the north slope of the San Gabriel Mountains (host is *Eriogonum nudum* Dougl. ex Benth. ssp. *saxicola* (Heller) S. Stokes; adults fly in August); see Plate 8, figs. 14-16. (2) Tehachapi Mts., Mt. Pinos, Lytle Creek, Chilao in San Gabriel Mountains (host in at least one locality is *Eriogonum roseum* Dur. & Hilg.; adults fly in July and August); (3) region around Ojai and Santa Paula in Ventura County and possibly coastal Santa Barbara County (host is *Eriogonum parvifolium* Sm. in Rees ssp. *paynei* C.B. Wolf ex Munz; adults resemble *P. e. smithi* Mattoni; an adult of the Santa Paula population figured on Plate 8, fig. 13; flies in July); and (4) vicinity of Cima in San Bernardino County (unknown host).

THE RITA BLUE

Philotes rita elvirae Mattoni

Plate 8, figures 20-22

This recently described (Mattoni, 1966) race of the Rita Blue is found in the fall along the western and southern edge of the Mojave Desert. It also flies in the Walker Pass area and along the east slope of the Sierra Nevada.

In various portions of its range, *elvirae* is geographically sympatric with four other earlier-flying *Philotes* species (Langston, 1969a). Records from Walker Pass Summit (Kern County) and the Juniper Hills, Little Rock, and Pearblossom areas (Los Angeles County) indicate a single brood flying from late July through mid-October, depending upon

seasonal rainfall patterns. Records toward Mono County indicate a July flight period in the northern portion of the subspecies' range. The type locality is a desert wash about 3.5 mi SW Pearblossom at 3400 ft elevation.

Foodplant: *Eriogonum plumatella* Dur. & Hilg. (Polygonaceae). The foodplant of populations along the east side of the Sierra Nevada is a subspecies of *Eriogonum microthecum* Nutt.

Early stages (text fig. 57): Described in detail by Comstock and Henne (1967). The echinoid egg is pale green and has a deeply depressed top as well as sloping sides. The usual network of raised white walls is present. The eggs are deposited singly, each deep in the flower of the buckwheat. The mature larva is ivory white in ground color, with a slight tinge of green. There is a discontinuous middorsal

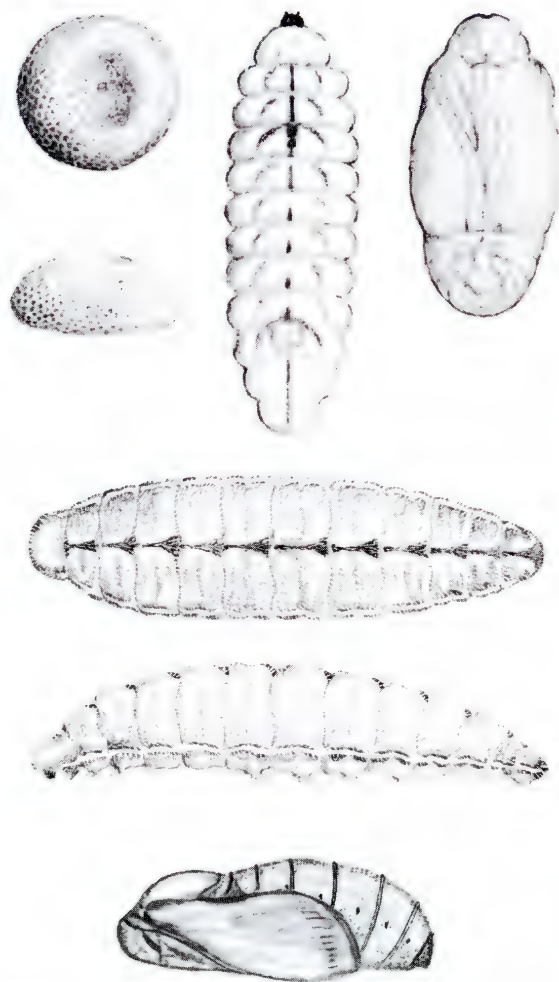


FIGURE 57. Egg, mature larva and pupa: *Philotes rita elvirae*—upper four figures (from Comstock, 1967). Larva (dorsal and lateral views) and pupa: *P. speciosa*—lower three figures. (Paintings by C. M. Dammers.)

line of pinkish brown dashes, and a diagonal dorso-lateral line of brownish pink on the side of each segment. The body surface is covered with minute white stubby knobs or setae. Pupation occurs among small flat pebbles and dried twigs near the base of the foodplant. The pupa (6 mm in length) is at first a delicate green and later changes to a uniform orange-yellow. No body hairs were noted.

THE MOJAVE BLUE

Philotes mojave Watson & Comstock

Plate 8, figures 17-19

The Mojave Blue flies in the springtime over the Mojave and Colorado Deserts of southern California. Populations are occasionally encountered on the bordering western mountain slopes. The species is often ecologically sympatric with other spring-flying *Philotes* species (*battoides bernardino* and *b. martini*, *speciosa*, and *sonorensis*), but the genitally closely related *P. enoptes dammersi* flies in the fall in areas of sympatry (Langston, 1969a, and Shields, unpublished data). The southernmost records are from Pinyon Crest and south of Cottonwood Springs (Joshua Tree National Monument) in Riverside County. Many populations occur in north-eastern Los Angeles County (Littlerock, Pallette Creek, Juniper Hills, Bob's Gap, Valyermo, etc.), and collections of the species extend west to Walker Pass and east through Lucerne Valley to the Old Woman and Sheephole mountains of San Bernardino County, and the Coxcomb Mountains of Riverside County. The flight season of the single brood is April to early May.

Foodplant: *Eriogonum pusillum* Torrey & Gray and probably *E. reniforme* Torr. & Frem. (Polygonaceae).

Early stages (text fig. 58): Described in detail with a color plate in Comstock (1966). The echinoid egg is ivory white and the top is deeply depressed with a minute micropyle in the center. The usual *Philotes* reticulation of raised walls covers the surface. The mature larva is not yellow-green like the earlier instars but is yellow in ground color, heavily overlaid with bars, dashes, and spots of deep rose, arranged in regular patterns. A heavy coating of minute white hairs is present. The hairless pupa is brown, with a slight yellow tinge on the abdominal segments.

THE SMALL BLUE

Philotes speciosa (Hy. Edwards)

Plate 8, figures 23-25

When the deserts spread their carpets of varicolored wildflowers and the spring sun warms the sands on windless days, the adults of *Plebejus speciosa* wend their way in fair abundance. "The



FIGURE 58. Egg, second instar and mature larvae, and pupa: *Philotes mojave*. (From Comstock, 1966.)

butterfly has a weak and inconspicuous flight, which would pass unnoticed by all save the skilled observer. It hovers a few inches above the ground, pausing occasionally to rest. Frequently the moving shadow of this tiny desert wraith may be more readily observed than is the insect itself. The Mojave is a land of heavy winds. During the month of April, when *speciosa* is abroad, these cutting blasts begin about eleven o'clock in the morning. Collecting must therefore be done in the calmer early hours, or else in the late afternoon, when the blowing usually ceases, and the butterflies are settling to rest" (Comstock, 1927a).

Populations of the Small Blue are found in the Mojave Desert from Mint Canyon and Pearblossom to Red Rock Canyon, Randsburg and Havilah (type locality), Kern County, and south in the western Colorado Desert (Thorne, 1961; and Langston, *in litt.*) to In-Ko-Pah Gorge (30 mi W El Centro), Imperial County, and Sweeney Pass (15 miles north of Jacumba), San Diego County (Langston, 1969a and *in litt.*). Occasionally, a very local population of *P. speciosa* is found in the mountains: for example, in Ventura County or at Chilao Creek at

5800 ft in the San Gabriel Mountains, Los Angeles County; the foodplants in these high altitude areas remain to be determined.

The flight period of the single brood is normally April to the first part of May, with occasional adults in mid-March.

Foodplants: *Oxytheca perfoliata* T. & G. in the Mojave Desert, *O. trilobata* Gray at Little Rock in Los Angeles County, and *Eriogonum reniforme* Torr. & Frem. (Polygonaceae) in both the Mojave and Colorado deserts (see Thorne, 1961).

Early stages (text fig. 57): Described in detail by Comstock and Dammers (1932). The eggs are laid singly on the foodplant and hatch in 8 days. The larvae may be fed in the laboratory on a substitute foodplant found in coastal areas, *Chorizanthe californica* (Benth.) Gray (Polygonaceae). On either this plant or *Oxytheca*, the larvae feed only on the small fleshy points which arise from the stem around the leaf junctures. When at rest, the protectively colored larvae curl around the stem on the inside of the bracts. The narrow mature larva is apple green, covered with short white hairs. Most specimens have a mauve or rose colored middorsal band which expands near the posterior edge of each segment. The caudal segments are slightly tinged with rose. Pupation occurs in a loose silken web on the soil, and the pupa overwinters. The pupa is a chestnut brown.

THE SONORA BLUE

Philotes sonorensis (Felder & Felder)

Plate 8, figures 26-28

This beautifully and distinctively colored blue has an extensive range through cismontane southern California, as well as occurring in scattered populations in central California and Baja California. The brilliant blue iridescence and prominent red splotches are unmistakable characters. *Philotes sonorensis* is an early spring flyer, peaking in February and March most years, but at higher elevations the adults may fly in May or even June. Complete details of population sites and the general biology of the species are given in excellent publications by Langston (1963, 1965, 1969a). It occurs on the coast near Santa Barbara and La Jolla (San Diego County). The classic lower cismontane localities are Azusa and the San Gabriel River wash in Los Angeles County. Populations have not been found in the desert ranges to date.

An adult form with all black spots missing except the central forewing spot (form "comstocki") is present in fair proportions (and both sexes) in certain populations and apparently is a simply-inherited genetic variant.

Foodplants: *Dudleya lanceolata* (Nutt.) Britt. &

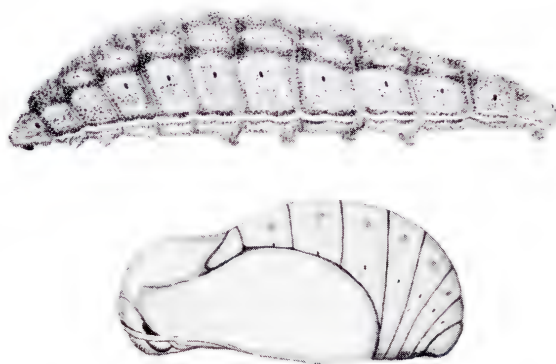


FIGURE 59. Mature larva and pupa: *Philotes sonorensis*. (Paintings by C. M. Dammers.)

Rose (Crassulaceae) in southern California and probably other stonecrops.

Early stages (text fig. 59): Described in complete detail by Comstock & Coolidge (1930); the foodplants discovered recently have all been *Dudleya* species, not *Sedum* as reported by them. Comstock and Coolidge state, "The eggs are placed mainly on the undersurface of the leaves, but may also be deposited on the upper sides and even on the stalks. The larvae feed on the contents of the thick, juicy leaves, sometimes crawling entirely within, but usually several of the posterior segments are left protruding. The apical portion of the leaves seems to be the preferred part, and even the stalk may be riddled. In moulting, the larvae withdraw from the leaves and descend usually to the undersurface. Pupation takes place in debris about, or at the base of the foodplant." The egg has a flattened top and bottom, and is a delicate pea-green color with a raised white network. The mature larva is quite variable in color, ranging from a pale green to a mottled rose. The pupa is a light brown.

THE ARROWHEAD BLUE

Glaucopsyche piasus (Boisduval)

The arrowhead-shaped, bold white markings on the undersides of the hindwings give this blue its common name. Two races of *Glaucopsyche piasus* as defined by Brown (1971) are found in our area; they are quite local and are never abundant.

(a) THE ARROWHEAD BLUE

Glaucopsyche piasus piasus (Boisduval)

Plate 8, figure 37

The typical, rather lightly marked subspecies occurs at higher elevations outside the deserts from the San Bernardino Mountains north through the Frazier Park, Lake of the Woods, and Wegis Ranch (Hwy. 33) areas of Kern and Ventura Counties, and north along the west and east slopes of the Sierras

through Kern, Tulare, and Inyo (e.g., Ninemile Canyon) counties. It flies in a single brood from late March to May, or occasionally June at the highest elevations it inhabits. There are several records of the species in San Diego County (Warner Springs, Pine Valley, and 3 mi W Lake Henshaw Dam), but it is exceedingly rare there.

Foodplants: *Lupinus albifrons* Benth. is a host in Lake County and the plant is found in our area. The butterfly is intimately associated with *Lupinus excubitus* Jones along the east slope of the Sierra Nevada in Inyo and Kern counties. One of us (J.F.E.) has reared ova found on an *Astragalus* species at Ninemile Canyon, southern Inyo County. All these hosts are in the family Leguminosae.

Early stages (no text fig.): Undescribed in publications, except for the egg (Comstock, 1927a). The early stages closely resemble those of *Glaucopsyche lygdamus*. Diapause is in the pupal stage.

(b) THE COASTAL ARROWHEAD BLUE

Glaucopsyche piasus sagittigera (Felder & Felder)

Plate 8, figures 35, 36

This beautifully-marked smaller race with dark undersides is now extinct or in immediate danger of extinction. It was apparently restricted to the coastal regions in the vicinity of Los Angeles and has not been taken in recent years. Even in 1927, Comstock commented: "This was formerly a very common species in the lowlands of Los Angeles County, but the gradual disappearance of the wild flowers along with the development of subdivisions is thinning out the colonies." The former subspecies name *catalina* (Reakirt) is a synonym; the species, incidentally, has not been found on the offshore islands of Santa Catalina or Santa Cruz. The flight period of recorded specimens includes March to April.

Foodplant: Unidentified *Lupinus* species (Leguminosae).

Early stages (text fig. 60): Unpublished, but the larva was reared by Dammers (see figure). The body is greenish white, finely speckled with soiled white and minute, dark red. Middorsal and subdorsal,

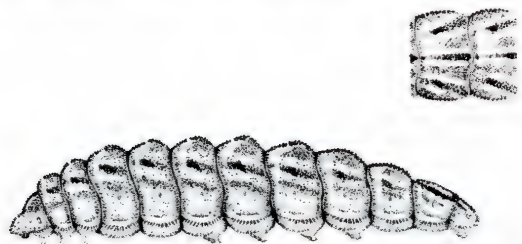


FIGURE 60. Larva (insert, dorsal view two larval segments): *Glaucopsyche piasus sagittigera*. (Paintings by C. M. Dammers.)

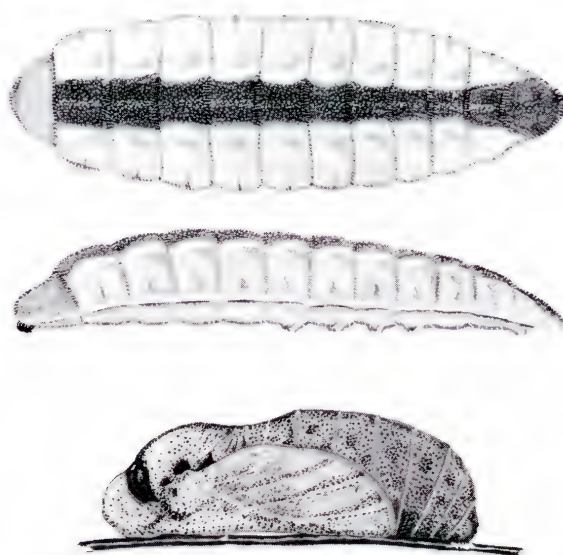


FIGURE 61. Mature larva (dorsal and lateral views) and pupa: *Glaucopsyche lygdamus australis*. (Paintings by C. M. Dammers.)

broken, dark red bands run the length of the body. On the back of the prothorax is a pale blue area heavily speckled with dark red.

THE SOUTHERN BLUE

Glaucopsyche lygdamus australis Grinnell

Plate 8, figures 29-31

Despite the pattern differences, this abundant blue has the same structural features as the rare Arrowhead Blue and hence both are placed in the same genus (Brown, 1971). The Southern Blue flies in abundance throughout cismontane southern California, wherever its foodplant grows commonly (especially in disturbed areas such as recent burns, road cuts, and canyon slopes). The race occurs from northern Santa Barbara County to San Diego County, flying in a single brood from February to April. It is also recorded from Santa Cruz Island, where late April was the end of its flight period (Langston, *in litt.*). In central San Luis Obispo County, populations begin assuming the characters (larger black spots, lack of blue on the female) of the northern Coast Range race, *G. l. behrii* Edwards (Langston, 1969b and *in litt.*).

Foodplant: *Lotus scoparius* (Nutt.) Ottley (Leguminosae) is the sole host of this subspecies, to our knowledge.

Early stages (text fig. 61): Described by Comstock (1929a) and Comstock and Dammers (1934). The echinoid egg is flattened above and below, with a raised white network over the surface. The eggs are laid singly on the tender leaf tips of the *Lotus* host. The mature larva is a vivid green, covered with silvery white hairs. A broad distinctive middorsal band

of dark magenta grades to scarlet at its edges, with a row of yellow triangles (light mauve centers) on either side of this band. Pupation occurs on the foodplant, using a silk button and girdle. The pupa is pale brown, profusely speckled with black dots arranged in groups. A few short white hairs occur on the head and posterior portions of the abdomen.

Other Remarks: Two additional population groups occur in southern California but have not been named. One is found in the Providence, New York, Clark, and Kingston ranges of the eastern Mojave Desert. It flies in March and April, and uses an unidentified *Astragalus* species (Leguminosae) as host. The eggs are laid on the flower buds of the *Astragalus*. The larvae feed first on the buds and flowers, then bore into the hollow seed pods and feed on the seeds. Diapause is in the pupal stage. The butterfly tends to be rather scarce. Some Providence Mountains specimens have been referred to as *G. l. oro* Scudder; however, the females are phenotypically different and *oro* is not found in California (Langston, 1969b); nor does the Sierran *G. l. columbia* Skinner match this desert mountain butterfly. This distinctive subspecies is figured on Plate 8, figs. 32, 33, 34.

A second unnamed population of *G. lygdamus* flies in the Panamint Range, associated with *Lupinus excubitus* Jones. It is a higher altitude popu-

lation than the preceding and is somewhat different phenotypically. The adults fly in May and June.

THE SPRING AZURE

Celastrina argiolus (Linnaeus)

One of the most widespread and phenotypically variable lycaenids in North America, *Celastrina argiolus* is distributed from the subarctic in northern Canada to the tropical mountains of Central America. Many geographic races and seasonal forms have been named. In southern California we have two recognized subspecies of this spring-flying blue:

(a) THE ECHO BLUE

Celastrina argiolus echo (Edwards)

Plate 8, figures 38-40

The Echo Blue is found throughout cismontane southern California and on Santa Catalina and Santa Cruz Island. It flies from the early spring to summer (February to July), depending upon elevation. It may be double brooded in the lowlands and foothills, depending upon the amount of moisture present and condition of the hosts. At the higher elevations, adults are more heavily bordered with black.

Foodplants: *Ceanothus* species (Rhamnaceae), Dogwood, *Cornus* (Cornaceae), *Spiraea* (Rosaceae); several legumes according to Comstock (1927a).



FIGURE 62. Eggs, larvae (various color morphs) and pupae: *Celastrina argiolus*. (From Edwards, 1884.)

The precise foodplants in our area need to be investigated, especially with regard to the frequency each is used.

Early stages (text fig. 62): Recorded by various authors for the eastern United States representatives of this species, but not from material in our area. The turban-shaped egg is pea green, and the reticulation on other lycaenid eggs is gathered into a series of pale stubby prominences. The mature larva is widely variable in pattern and color (see figures), from nearly pure green to magenta in ground color. The pupa is brown.

(b) THE CINEREOUS BLUE

Celastrina argiolus cinerea (Edwards)

Not figured

This race is found in the mountain ranges of the eastern Mojave Desert and north along the east slope of the Sierra Nevada. It tends to be smaller and rather darker. The flight period is March to July.

Foodplant: Rock Spiraea, *Petrophytum caespitosum* (Nutt.) Rydb. (Rosaceae), a plant that grows in mats on limestone ledges in these eastern desert ranges. Lane has observed oviposition on flower buds of *Chamaebatiaria millefolium* (Torr.) Maxim. (Rosaceae) along Pine Creek in Inyo County.

Early stages (no text fig.): Undescribed.

Family MEGATHYMIDAE

Members of the giant skipper family are found in the deserts of our southern California area and throughout the Southwest. The arid deserts of northern and central Mexico are the centers of greatest speciation. In the latest review of the family, Freeman (1969) recognized 49 species and 15 subspecies in this New World family.

The adults are characterized by a large robust body, a small head (half the width of the thorax), clubbed antennae, a wing expanse of usually over 50 mm, and extremely fast, powerful flight. The larvae bore in the stems of *Yucca*, *Agave*, or *Manfreda* plants, and the pupae have the remarkable

ability to move up and down in the larval tunnel. All known species are single brooded. Of our two genera, *Agathymus* use *Agave* as hosts and are fall fliers, while *Megathymus* use *Yucca* and are spring fliers.

It may seem to the average person that a butterfly collector merely runs across flower-strewn meadows, net in hand, in pursuit of his prey. Those of us who have collected in the west and especially southern California know that there are often considerable hazards such as rattlesnakes, rocky cliffs, and scorching sun in isolated desert mountains, that must be endured before the prize species is found. This is especially true for the giant skippers, which are best collected as resting adults or in the larval stages by careful searching of the hosts, rather than by swinging a net. The problems involved in working out the life history of such an insect as the giant skipper are dramatically told in the saga recorded by John Adams Comstock (1956).

STEPHENS' SKIPPER

Agathymus stephensi (Skinner)

Plate 8, figures 47, 51

Stephens' Skipper is distributed along the western edge of the Colorado Desert from the Palms-to-Pines Highway in Riverside County south to northern Baja California. The area of greatest abundance seems to be the western portion of Anza-Borrego Desert State Park, especially near Scissors Crossing (San Diego County). The flight period is September to October. The adults can be collected at night; they roost on shrubs and small trees such as junipers and stand out with the aid of a lantern. Males exhibit perching behavior and perhaps territoriality around *Agave* plants; they apparently wait for newly emerging females at these points.

Foodplant: *Agave deserti* Engelm. (Agavaceae).

Early stages (text fig. 63): The eggs are "flipped" by the female into the leaf bases of the plant. The



FIGURE 63. Eggs, mature larvae and pupae: *Agathymus stephensi*—left; *Megathymus coloradensis martini*—right. (Paintings by C. M. Dammers.)



FIGURE 64. *Agathymus alliae* subspecies in host, *Agave utahensis* var. *nevadensis*. Left: larva in tunnel with outer part of wall cut away. Right: pupa in chamber, with finger pointing to "trapdoor" through which adult escapes after emerging from pupa. (Photographs by Julian P. Donahue.)

larvae bore in the leaves of the *Agave* plant and pupate in a chamber near the base of the leaf. The adult leaves the leaf through a "trap-door" fashioned by the larva before it pupates.

ALLIE'S SKIPPER

Agathymus alliae (Stallings & Turner)

Plate 8, figures 42, 43

The typical form of this skipper was described in 1957 from near Cameron along the Little Colorado River in Arizona, but a new subspecies has been found in our area and southern Nevada and will shortly be named by Roever. In California, it flies in the Ivanpah, Clark, and Kingston ranges of the eastern Mojave Desert. The flight period is September to October. The *Agave* foodplants grow on rocky, arid, limestone slopes at 3000 to 5000 ft elevation.

Foodplant: *Agave utahensis* Engelm. var. *nevadensis* Engelm. ex Greenm. & Roush. (Agavaceae).

Early stages (text fig. 64): Undescribed, although photographed (see figures). Stallings and Turner report that the females in Arizona select medium

sized plants for oviposition, and that the larval trap door, which is paper white, is placed on the underside of the leaf.

BAUER'S SKIPPER

Agathymus baueri (Stallings & Turner)

Plate 8, figures 45, 46

The typical subspecies of Bauer's Skipper is found in west central Arizona. An unnamed subspecies (soon to be described by Roever) occurs in the Providence Mountains and the Granite Mountains north of Amboy, San Bernardino County. The flight period is late September to October. The butterfly is found on rocky slopes, usually in limestone areas, from 4000 to 6000 ft elevation.

Foodplant: *Agave deserti* Engelm. (Agavaceae).

Early stages (no text fig.): Undescribed.

THE COMMON GIANT SKIPPER

Megathymus coloradensis Riley

Three subspecies of this broadly distributed giant skipper fly in different areas of southern California.

(a) MARTIN'S GIANT SKIPPER

Megathymus coloradensis martini Stallings & Turner

Plate 8, figures 41, 44

Martin's Giant Skipper is distributed along the western and southern edges of the Mojave Desert, and south along the western edge of the Colorado Desert in Riverside County to eastern San Diego County. The type locality is Little Rock, Los Angeles County. The flight period is March to April, occasionally as early as January and February.

Foodplant: *Yucca brevifolia* Engelm. in Wats., *Yucca schidigera* Roezl ex Ortgies (Agavaceae).

Early stages (text fig. 63): The eggs are laid on suckers or new shoots of the *Yucca* plants. The newly hatched larvae bore into the center of the plant and build a tower of silk and frass. During the late winter months the pupae move up and down the burrows inside the *Yucca* plant, apparently moving up into the tower for warmth during the day and down at night into better insulated quarters. They are capable of quite rapid downward movement into the burrows when disturbed.

(b) MAUDE'S GIANT SKIPPER

Megathymus coloradensis maudae Stallings,

Turner & Stallings

Not figured

Maude's Giant Skipper is found in the eastern Mojave Desert, through the Providence, New York, Clark, and Kingston ranges, and flies in March and April. It is barely distinguishable from *martini*. (A similar subspecies, *M. c. navajo* Skinner, is sometimes credited to our area based on the phenotype of a population in the Little San Bernardino Mountains; however, the actual range of *navajo* is much further to the east in New Mexico and central and western Colorado.)

Foodplants: *Yucca baccata* Torr., *Y. brevifolia* Engelm. in Wats., *Y. schidigera* Roezl ex Ortgies (Agavaceae). *Yucca baccata* seems to be preferred over the other two hosts.

Early stages (no text fig.): Undescribed, although reared by many workers.

(c) *Megathymus coloradensis* subspecies

Not figured

In coastal San Diego County, a markedly different habitat from that of *martini* or *maudae*, occurs an undescribed population of *M. coloradensis* first discovered in the Del Mar area. Adults fly in March.

Foodplant: *Yucca schidigera* Roezl ex Ortgies (Agavaceae).

Early stages (no text fig.): Undescribed, although reared.

Family HESPERIIDAE

The skippers are small to medium butterflies with a rapid, skipping flight. They have stout bodies, long narrow wings, six well-developed legs, and with their often drab coloration, resemble some of the small moths. This worldwide family is particularly diverse in the New World and reaches its greatest abundance of species in the American tropics. Many species are frustratingly close in coloration and pattern, and can only be separated with certainty through genitalic examination.

The eggs are usually spherical with a broad, flattened base. The larvae commonly possess a constricted "neck" portion behind the head, and may be smooth or finely hairy. The pupa is frequently attached to the substrate by a silken girdle, and pupation often takes place inside a shelter constructed by the larva from living or dead leaves of the host.

THE WANDERING SKIPPER

Panoquina panoquinoides errans (Skinner)

Plate 9, figures 1-3

The Wandering Skipper is distributed along a narrow coastal strip from Santa Barbara and Ventura (near the mouth of the Santa Clara River) to San Diego County. In the Los Angeles area, a colony was recently found along the old canals of Venice (Lane) and other populations are known in the San Pedro-Cabrillo Beach area. Captures are recorded for July through September; it is uncertain as to whether there is an earlier brood.

Foodplants: Dammers (*in litt.*) records Salt Grass, *Distichlis spicata* (L.) Greene (Gramineae). Other native foodplants not known, but females will oviposit on grass species and larvae readily feed on thin bladed grasses.

Early stages (text fig. 65): Described by Comstock (1930). The spherical egg with flattened bottom is whitish. The mature larva is deep green, with a dark green middorsal stripe and a lateral band of yellowish white. The pupae are attached right-side-up on the foodplant with a girdle and silk button. The pupa is greenish brown in color, and has a prominent palpal case projecting forward from the head.

THE EUFALA SKIPPER

Lerodea eufala (Edwards)

Plate 9, figures 4-6

This skipper is sometimes confused with the preceding species, but *errans* has cream yellow forewing spots and *L. eufala* has white spots with a uniformly gray ventral surface on the hindwings. The Eufala Skipper flies throughout the Colorado River, Imperial and Coachella valleys, and the coastal lowlands of San Diego, Orange and Los



FIGURE 65. Mature larvae and pupae: *Panoquina panoquinoides errans*—left (inserts, dorsal view two larval segments); *Lerodea eufala*—right (inserts, egg, dorsal view of larval segments and anterior view of head capsule). (Paintings by C. M. Dammers.)

Angeles counties. The flight period in the desert valleys is July to October, and along the coast from August to October.

Foodplants: Unidentified grasses.

Early stages (text fig. 65): Illustrated by Comstock (1929) and described some years earlier by Coolidge. The egg is a delicate pale green. The mature larva is vivid grass green, covered with black papillae bearing hairs. The middorsal dark green line is bordered with a blotching of yellow. Laterally, there is a yellow suprastigmatal stripe and a white substigmatal line. The segmental creases are bright yellow. The pupa is green, with a prominent dark green dorsal line. A subdorsal whitish band is also present.

THE DUN SKIPPER

Euphyes vestris (Boisduval) subspecies

Plate 8, figures 48-50

A subspecies of this eastern North American species occurs in San Diego County and appears distinct as well as highly isolated from the nearest populations to the north (in Santa Cruz and Mendocino counties) and east (in Arizona). In the scattered colonies in San Diego County the Dun Skipper typically flies where there is a seep or spring and is extremely local. Most colonies are at low elevations. The principal flight period is June, with some late May and early July records.

Foodplant: Unknown in southern California. The species feeds on *Cyperus* sedges (Cyperaceae) in the east.

Early stages (no text fig.): Undescribed for our population, but Heitzman (1964) has described the early stages of the eastern *Euphyes vestris metacomet* (Harris).

THE UMBER SKIPPER

Paratrytone melane (Edwards)

Plate 9, figures 7-9

A common skipper of southern California, *Paratrytone melane* flies in the lowlands and canyons of the mountains near the coast, and along the west slope of the Sierra Nevada. Adults generally prefer small grassy glades along watercourses or in shady forest areas. The flight period involves two broods, one flying in April to June and the other in July to September.

Foodplants: Grasses. A female was observed (Henne) ovipositing on *Deschampsia caespitosa* (L.) Beauv. (Gramineae) in La Sierra Canyon of the Santa Monica Mountains; otherwise, no specific wild host grass species known. It will feed on Bermuda Grass (*Cynodon dactylon* (L.) Pers.) in the laboratory.

Early stages (text fig. 66): Described by Comstock and Dammers (1931). The hemispherical egg has an apparently smooth surface, but on high magnification a low reticulation of irregular hexagonal cells is apparent. The mature larva is dirty yellow-green in color and mottled with black punctae of

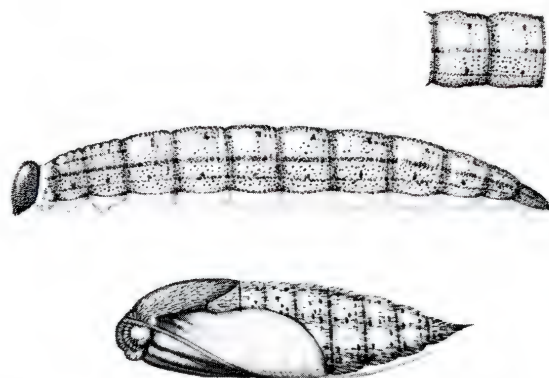


FIGURE 66. Mature larva and pupa (insert, dorsal view two larval segments): *Paratrytone melane*. Note long proboscis case. (Paintings by C. M. Dammers.)



FIGURE 67. Mature larvae and pupae (inserts, dorsal views of two larval segments and anterior view head capsule); *Ochloides sylvanoides*—left—note long proboscis case; *O. agricola*—right. (Paintings by C. M. Dammers.)

varying sizes, having some tendency toward arrangement in transverse rows. The middorsal line is blackish. The head is yellow brown, thickly covered with minute brown pits and whitish hairs. The body is profusely covered with short colorless hairs. Pupation takes place in a puparium, formed by uniting several strands of grass, with a loose inner lining of silk. The pupa is a light straw color, tinged with pink; as it matures, the color changes to a light grayish ochre. Short yellowish hairs occur over the surface except on the wing cases.

THE WOODLAND SKIPPER

Ochloides sylvanoides sylvanoides (Boisduval)

Plate 9, figures 10-12

The Woodland Skipper flies abundantly throughout the mountains of southern California in Upper Sonoran and Transition Zone habitats. It is not found in the desert ranges. The distinguishing feature is the almost uniformly colored, yellow-brown underside of the hindwings. The adults are very common in late summer and early fall in the middle elevations of our mountains. The flight period is June to September.

Foodplant: Grasses; no specific published records.

Early stages (text fig. 67): Described by Comstock (1929b). The egg is unrecorded. The mature larva is buff yellow, with a black head. Seven blackish longitudinal stripes run from the narrow neck region to the last segment. The pupa is cream in ground color, with a whitish "bloom" over most of the surface; the anterior portions are shaded with brown and the eye cases are reddish brown. Hairs (dirty cream in color) are present on the eyes, frontal portion of the head, the top of the thorax, and the top of the abdomen. The adult emerges in six days, suggesting that the overwintering stage is the egg or first-instar larva.

THE RURAL SKIPPER

Ochloides agricola (Boisduval)

Plate 9, figures 13-15

Three subspecies of this skipper occur in our area, according to Stanford who has made a careful study of the species. He concludes that *O. a. agricola* (Boisduval) is applicable to all populations in southern California north to the Tehachapi Mountains, and from there northward on the west side of the great central valley of California to the northern limit of the species. *O. a. nemorum* (Boisduval) is applicable to the Sierra foothill populations from the Tehachapi region northward into blend-zone populations in the Shasta region; it is a weakly differentiated subspecies. *O. a. verus* (Edwards) is a very distinct population limited in known distribution to the Havilah region of Kern County; it has extremely light markings. The flight period of the species is from May to July.

Foodplants: Grasses.

Early stages (text fig. 67): Described in part by Comstock (1927b). The dull white egg is cone-shaped and the surface is covered with slightly raised ridges in a minute honeycomb pattern. The first-instar larva is white with a black head. A narrow black transverse band with a black lateral spot below each end occurs on the dorsal area of the prothorax. Small black spots occur on the remaining segments in the dorsal and lateral areas.

THE YUMA SKIPPER

Ochloides yuma yuma (Edwards)

Plate 9, figures 16-18

The southern limit of the Yuma Skipper barely intrudes into our area, at Lower Haiwee Reservoir in Inyo County. Tilden (1957b) has made a careful study of this skipper's taxonomic history and known distribution. It is considered a rare species and is



FIGURE 68. Egg—upper; pupa—dorsal view, left; ventral view, right: *Ochloides yuma*. (Photographs by T. C. Emmel.)

uncommon even in the several large colony areas in Inyo County. The first brood flies in June; the fall brood of *yuma* appears in August and flies through mid-September. The usual habitat is a moist spot in otherwise arid country, where Common Reed (*Phragmites communis*) is abundant.

Foodplant: *Phragmites communis* Trin. var. *berlandieri* (Fourn.) Fern. (Gramineae).

Early stages (text fig. 68): Undescribed, although photographed.

THE FIELD SKIPPER

Atalopedes campestris (Boisduval)

Plate 9, figures 19-21

The Field Skipper occurs from southern California across the continent to the Atlantic; however, it is generally uncommon in its lowland and cismon-tane southern California habitats. It has been recorded as an occasional capture in Los Angeles, Riverside, San Bernardino, and San Diego counties, in the summer and fall. It may be less common today than it was in Comstock's early collecting experience (Comstock, 1927a).

Foodplant: Grasses; Bermuda Grass in the laboratory.

Early stages (text fig. 69): Described by Comstock (1929b). The egg is a delicate greenish white and is hemispherical in shape, with a flattened bottom. The mature larva has a black head and a dark olive green body, profusely covered with minute black nodules, surrounded with dark green bases; each nodule bears a single microscopic black hair. A dark greenish brown middorsal line runs the entire length of the body and the first cervical segment (neck) bears a black transverse line or collar. The pupa is blackish brown, darker on wing cases, thorax and head.

THE SANDHILL SKIPPER

Polites sabuleti (Boisduval)

We find two subspecies of this skipper in southern California:

(a) THE SANDHILL SKIPPER

Polites sabuleti sabuleti (Boisduval)

Plate 9, figures 22-24

The Sandhill Skipper in its typical race, *Polites sabuleti sabuleti* (Boisduval), flies throughout the lowland coastal areas of southern California. The flight period is April to September. The most characteristic habitats are sandy areas near the coast, such as the El Segundo Dunes and Venice,

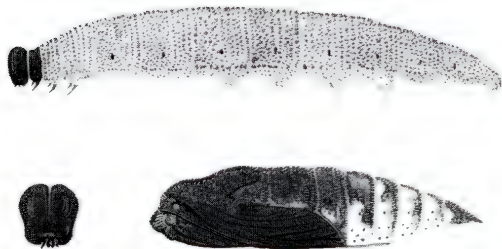


FIGURE 69. Mature larvae and pupae (inserts, anterior view of head capsules): *Atalopedes campestris*—left; *Polites sabuleti*—right. (Paintings by C. M. Dammers.)

but it occurs as high as Castaic and the Ridge Route in the Tehachapis.

(b) THE CHUSCA SKIPPER

Polites sabuleti chusca (Edwards)

Plate 9, figures 25, 26

In the deserts and especially in the Imperial Valley flies a more lightly marked subspecies, *Polites sabuleti chusca* (synonymous with *P. s. comstocki* Gunder). It is found in widely scattered populations for the most part, from Palmdale in Los Angeles County to Scissors Crossing in San Diego County, and east to Blythe on the Colorado River. It prefers areas where Salt Grass grows around alkali sinks and desert springs.

Foodplant: Probably Salt Grass, *Distichlis spicata* (L.) Greene (Gramineae) in our area; Bermuda Grass in the laboratory.

Early stages (text fig. 69): The egg and larva are briefly described by Comstock (1929b), and a painting by Dammers is available (see figures). The egg is delicate green, with a finely granular surface covered with an irregular reticulation of slightly raised walls. The larva is green with a jet black head. The pupa is generally yellowish green with a pink shading becoming more pronounced toward the rear.

THE SONORA SKIPPER

Polites sonora sonora (Scudder)

Plate 9, figures 27-29

While a common species in the Northwest and in northern California, the Sonora Skipper is rather rare south of Kern County. It is found in the San Bernardino Mountains, especially the Barton Flats area, and may be expected to turn up in the San Gabriel Mountains with further collecting. It flies from May to August.

Foodplant: Unknown.

Early stages (no text fig.): Unknown.

THE HARPALUS SKIPPER

Hesperia harpalus (Edwards)

The similar appearance of many of the species of *Hesperia* has led to great confusion in the past literature as to which species were actually present in southern California. The outstanding monographic treatment of the genus by MacNeill (1964) cleared up many of the taxonomic and identification problems that had previously caused lepidopterists to shun these attractive skippers. Within the species *Hesperia harpalus*, there are four sets of differentiated populations in southern California (arranged below from north to south):

(a) THE YOSEMITE SKIPPER

Hesperia harpalus yosemite Leussler

Plate 9, figures 39-41

Hesperia harpalus yosemite occurs along the western slope of the Sierra Nevada and flies from early summer to late fall, with the peak of the flight period in late summer and fall.

(b) THE HARPALUS SKIPPER

Hesperia harpalus harpalus (Edwards)

Plate 9, figures 30-32

Harpalus harpalus harpalus occurs along the eastern slope of the Sierra Nevada and flies from early to late summer (June to August).

(c) *Hesperia harpalus* subspecies

Plate 9, figures 36-38

In Kern County the Sierran alpine mountain barrier no longer separates the above subspecies and a series of blend-zone populations are found through the Tehachapi Mountains. The adults in these colonies fly at the same time as *H. h. yosemite*.

(d) LEUSSLER'S SKIPPER

Hesperia harpalus leussleri Lindsey

Plate 9, figures 33-35

From the mountains ringing the Los Angeles basin and the San Bernardino Mountains, south through the Laguna Mountains of San Diego County to Baja California, the fourth subspecies, *H. harpalus leussleri* occurs. The flight period of this southern race is late May to late August, with a peak in June and July.

Foodplants: Unknown in nature; grass species in the laboratory.

Early stages (no text fig.): Described in detail by MacNeill (1964) for *harpalus* and *yosemite* subspecies, which differ slightly in size and coloration at the various stages. The egg is creamy white. The mature (sixth instar) larva is yellow with pale markings and short hairs at various points. The pupa is dark brown with paler wing cases; no dark mottling is present, nor is there a glaucous bloom covering the body. Diapause is in the egg stage.

LINDSEY'S SKIPPER

Hesperia lindseyi Holland

Plate 9, figures 42-44

This skipper is distributed from north-central California south through the Coast Ranges and the Tehachapi Mountains and canyons of Los Angeles County, to the San Jacinto Mountains in Riverside County. There is one record of the species at Blythe, which may be a mislabeled specimen or one that hatched from an artificially transported egg (MacNeill, 1964). However, a few smaller and lighter *H. lindseyi* specimens have been collected in the Yuma Mountains, the Needles area, and various desert ranges east of U.S. 395 (Stanford, *in litt.*).

These may represent a desert subspecies. The flight period is from May to July.

Foodplants: *Festuca idahoensis* Elmer and *Danthonia californica* Boland (Gramineae), in north-central California (MacNeill, 1964).

Early stages (no text fig.): Described in detail by MacNeill (1964) for north-central populations. The egg is white to dull white, and is laid on the arboreal lichen *Usnea florida* (L.) Web. where it remains unhatched until the following spring. The larva (mature in the fifth instar) is brown with pale dorsal lateral bars and short hairs over the surface. The pupa is pale brown without dark mottling, and is covered with a light waxy bloom.

THE COLUMBIA SKIPPER

Hesperia columbia (Scudder)

Plate 9, figures 45, 46

The Columbia Skipper occurs along the Coast Ranges from southern Oregon to San Diego County in southern California. It is closely associated with chaparral throughout its range. Two annual broods fly, one in March to May and the other in September and October.

Foodplants: *Koeleria cristata* (L.) Pers. and *Danthonia californica* var. *americana* (Scribn.) Hitchcock (Gramineae), at least as oviposition substrates (MacNeill, 1964).

Early stages (no text fig.): Described in detail by MacNeill (1964). The eggs are white with a greenish tint and are laid on the larval foodplant. The mature larva (sixth instar) is pale cream to light yellow in ground color, with pale parallel bars. The pupa is pale brown, with sparse to rather heavy dark brown mottling. Some short hairs are present on both larva and pupa.

MARTIN'S SKIPPER

Hesperia pahaska martini MacNeill

Plate 9, figures 47-49

This skipper is known only from the Ivanpah, Providence, Clark, and New York Mountains of the eastern Mojave Desert in southern California. It occurs in southern Nevada, southern Utah, and probably extreme northern Arizona. Martin's Skipper is a large, brightly marked butterfly and has very large white spots ventrally. This double brooded subspecies flies in June and early July, and in the fall (September) in these desert ranges. Adults can be taken while feeding on rabbitbrush (*Chrysothamnus*) flowers in September. The foodplant is a low growing, densely tufted bunch grass of rather small size, and the larvae may need to move to adjacent bunches to complete their development (MacNeill, 1964).

Foodplant: *Tridens pulchellus* (H.B.K.) Hitchc. (Gramineae).

Early stages (no text fig.): Described in detail by MacNeill (1964). The egg is creamy white with a green tint, changing to dull chalky white with grayish cast. The eggs are deposited on the larval host, and hatch in about two weeks. Thus diapause in this species may be in a larval instar. The fifth instar larva is a light cream to yellowish color. The larvae construct a tube shelter into the basal parts of the bunch grass; the basal portion of the shelter may actually be a horizontal tube slightly below the soil surface in the case of an older larva. The pupa has not been described.

THE JUBA SKIPPER

Hesperia juba (Scudder)

Plate 9, figures 50-52

The Juba Skipper is widely distributed in the west, both geographically and ecologically. In southern California, it is found at Walker Pass in Kern County, at Little Rock and the canyons bordering the western Mojave Desert, the San Gabriel Mountains of Los Angeles County, and then extensively through the ranges of San Bernardino, Riverside, and San Diego counties. It has not been found in the eastern Mojave ranges. The double brooded flight period is April to June and August to September.

Foodplants: Unknown; grasses eaten in the laboratory.

Early stages (no text fig.): Described in detail by MacNeill (1964). The egg is cream white with a pink tint. The mature (fifth instar) larva is cream colored, with short hairs. The pupa is dark brown with paler and darker patches. Short hairs are also present.

THE EUNUS SKIPPER

Pseudocopaodes eunus (Edwards)

Plate 10, figures 1-3

The Eunus Skipper is rather rare and sporadic through the lowland desert areas, occurring in alkali flats. It ranges from the Scissors Crossing area of San Diego County north to the Mojave River (Afton Canyon) and Victorville area, thence north to Owens Valley. It flies in June and July and may be taken in fair abundance at the peak of its flight season.

Foodplant: Salt Grass (*Distichlis spicata* (L.) Greene) is suspected, since the butterfly is always associated with this plant.

Early stages (no text fig.): Only the egg has been described (Comstock, 1931). It is cream, and subconoidal in form with a fine surface reticulation of slightly raised walls.

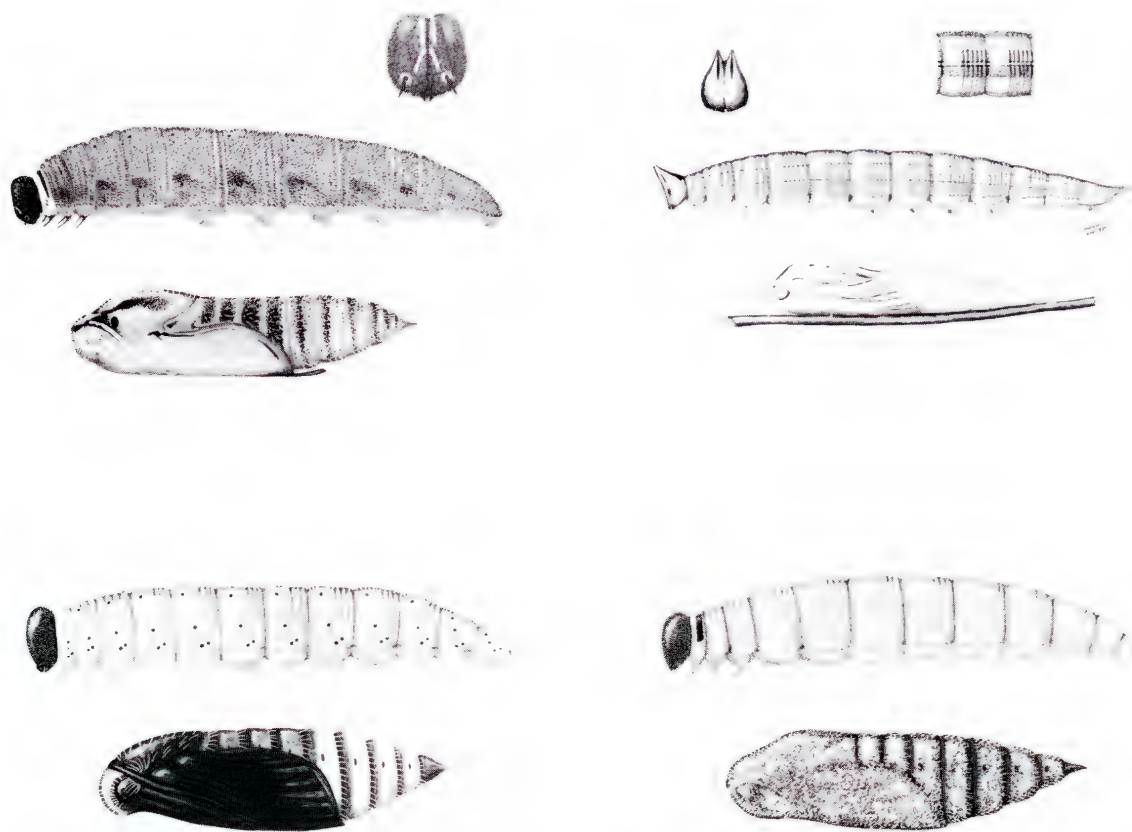


FIGURE 70. Mature larvae and pupae (inserts, dorsal view of two larval segments and anterior view of head capsule): *Hylephila phyleus*—upper left; *Copaeodes aurantiaca*—upper right; *Pholisora catullus*—lower left; *P. libya*—lower right. (Paintings by C. M. Dammers.)

THE CARUS SKIPPER

Yvretta carus (Edwards)

Plate 10, figures 4, 5

This drab dark brownish skipper is found along the Colorado River in San Bernardino County and apparently has been established in the irrigated portions of our deserts for years, since a large population was sampled at Fertilla in Riverside County by Rindge in 1939. The Carus Skipper is more widespread in Arizona. In southern California it flies in August to September.

Foodplant: Unknown.

Early stages (no text fig.): Unknown.

THE FIERY SKIPPER

Hylephila phyleus (Drury)

Plate 10, figures 6, 7

The Fiery Skipper is an exceedingly abundant insect throughout the lowlands of southern California. In the deserts it is rare and sporadic, and mainly occurs on lawns in settled areas. It is found as far north as Surprise Canyon in the Panamint Range in eastern California. The broader range of the species

runs from San Francisco to Argentina in South America. The sexes show considerable dimorphism in pattern and coloration, with a great range of variability in the females. The adults are especially attracted to *Lantana* flowers, and are very abundant on lawns. The flight period is April to December.

Foodplant: Bermuda Grass, *Cynodon dactylon* (L.) Pers. (Gramineae).

Early stages (text fig. 70): Described by Comstock (1927a, 1933). The egg is hemispherical, sharply flattened at the base. The surface is smooth and is a pale bluish green. The mature larva is a dirty yellowish brown or gray-brown, with dorsal and dorso-lateral brown stripes. The head and collar are black. The pupa is yellowish brown and bears a prominent black dorsal line. The pupa is thickly covered with sharp hairs, arising from low reddish brown tubercles.

HEWITSON'S SKIPPER

Copaeodes aurantiaca (Hewitson)

Plate 10, figures 8-10

This small, pure yellow skipper is found in the

Colorado and Mojave Deserts, generally in canyons or washes and in chaparral areas bordering the deserts. It ranges as far north as the Panamint Mountains. Many populations are recorded in San Diego, Imperial, Riverside and San Bernardino counties. The flight season extends from April to September. Males exhibit perching behavior along canyon bottoms and washes. The species is often overlooked because of its small size.

Foodplants: Unknown, though the larvae will feed on Bermuda Grass.

Early stages (text fig. 70): Recorded in detail by Comstock (1929b). The egg is cream and has a smooth and glistening texture; the shape is that of a flattened hemisphere. The mature larva is green with bands of a heavy purple shade running longitudinally on the dorsal surface. Two dark green bands occur on the lateral surface. The head is conoidal, with two points projecting dorsally. The face is crossed by two vertical bands of pink, with a large purplish area on the cheeks. The pupa is light straw in color, with a sharp elongate "beak" (the palpal case) projecting forward from the head. A few dark brown lines and dots appear as shown in the figures.

JULIA'S SKIPPER

Nastra julia (Freeman)

Plate 10, figure 11

This drab skipper used to be placed in the genus *Lerodea*, as congeneric with *L. eufala*. Phenotypically, it differs by the lighter yellowish cast dorsally and more ochreous overscaling ventrally, but the genitalia provide the only reliable characters for *julia* and the several other southwestern species of *Nastra*. *Nastra julia* is found in Riverside County (Blythe area) and Imperial County in late August to early October, but it is rare or at least little collected.

Foodplants: Unknown.

Early stages (no text fig.): Unknown.

THE SOOTYWING

Pholisora catullus (Fabricius)

Plate 10, figures 12-13

Pholisora catullus is a broadly distributed North American skipper, but in southern California it is found only sparingly in montane-desert interfaces, as in San Diego (Jacumba area) and Los Angeles (Little Rock) counties. It flies from April to September and apparently has at least two broods.

Foodplants: Unknown in southern California; pigweeds, *Chenopodium* species (Chenopodiaceae) and *Amaranthus* (a related family, the Amaranthaceae) are used elsewhere.

Early stages (text fig. 70): The conical egg is pale

yellow-brown, and has 15 vertical ribs. The mature larva is yellow-green, covered with small whitish tubercles, topped with short white hairs (Comstock, 1927a). The pupa is greenish yellow to brownish and is covered with a powdery dust.

THE MOJAVE SOOTYWING

Pholisora libya (Scudder)

Plate 10, figures 14-21

The Mojave Sootywing occurs throughout the Colorado and Mojave deserts. It flies from March to October in several broods and is rather common in the proper habitat. Specimens from San Diego, Imperial, Riverside, San Bernardino and eastern Kern counties are referable to the subspecies *P. l. libya* (Scudder), while those from Inyo County (e.g., Mono Lake area) are closer to *P. l. lena* (Edwards), according to Stanford (*in litt.*).

An undescribed set of *P. libya* populations is known from the southern end of the San Joaquin Valley, around the area of McKittrick in western Kern County. A long series of adults now in the Natural History Museum of Los Angeles County was collected by Martin and Truxal in May, 1954. The race is distinguished from other *libya* populations by its larger size and washed-out appearance of the underside of the hindwings. Additionally, the white markings on the underside of the secondaries are more prominent than in other *libya*.

Foodplants: Salt Bush, *Atriplex canescens* Jones (Chenopodiaceae).

Early stages (text fig. 70): Described from material collected at Indian Wells in Coachella Valley by Comstock and Dammers (1932). The egg is hemispherical with a strongly ridged surface; the color is at first a dull orange, changing to a soiled ivory white. Eggs are laid singly on the leaves of the *Atriplex*. The mature larva is cylindrical with a pale blue-green body which is covered profusely with white raised points. A single short white hair arises from each of these points. There are three lateral rows of black dots placed as shown in the figure. The head is black and profusely covered with orange hairs. The larva is reported to secrete itself in a protective nest formed of host leaves, united with strands of silk, from which it emerges only at times of feeding. The pupa is light brown, with black wing cases and thorax. There are light chestnut hairs above the eye cases and over the anterior portion of the head.

THE ALPHEUS SOOTYWING

Pholisora alpheus oricus Edwards

Plate 10, figures 22-24

The Alpheus Sootywing occurs in scattered populations through the Great Basin and Mojave

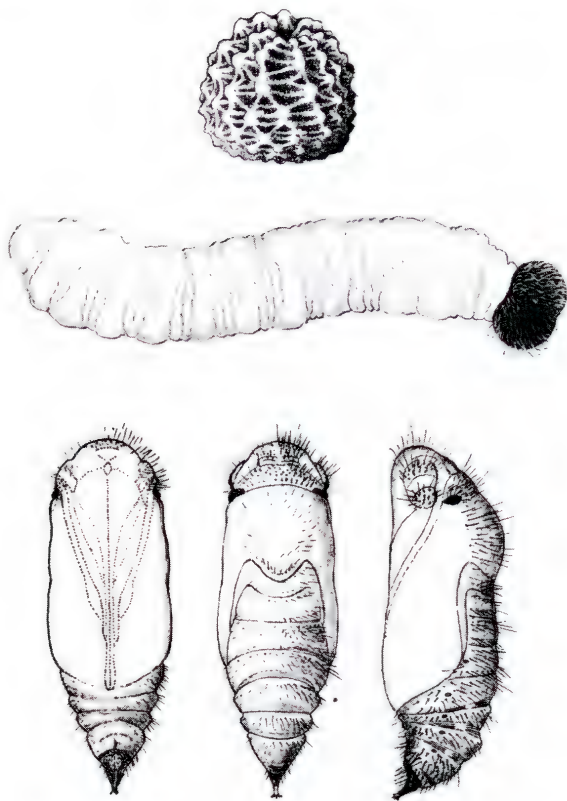


FIGURE 71. Egg, mature larva and pupa: *Pholisora graciellae*. (From Comstock, 1929.)

Desert areas, always in association with *Atriplex canescens*. Specific southern California records are Lucerne Valley in San Bernardino County and the Argus Mountains in Inyo County. The species is single brooded and flies from April to June. The flight is direct and fairly rapid. Adults are usually large and have a heavy layer of white overscaling on the upper surface of the forewing in fresh specimens. MacNeill (1970) provides additional characteristics to separate this and the following species.

Foodplant: *Atriplex canescens* James (Chenopodiaceae).

Early stages (no text fig.): Undescribed (Comstock's 1929b paper refers to the following species).

MACNEILL'S SOOTYWING

Pholisora graciellae MacNeill

Plate 10, figures 25-27

Pholisora graciellae, a recently described new species (MacNeill, 1970), is found along the Colorado River in San Bernardino, Riverside, and Imperial counties, including Bennett Wash in the vicinity of Parker Dam (type locality), the Earp area, Needles, and Blythe. It flies in April and July to October in two broods, and is associated with

Atriplex lentiformis, a large shrub that forms dense thickets along the drainage systems of the lower Colorado River. Its flight is very weak and fluttering. Comstock (1927a) figures this species as *P. alpheus*.

Foodplant: *Atriplex lentiformis* (Torr.) Wats. (Chenopodiaceae).

Early stages (text fig. 71): Described by Comstock (1929b) under the incorrect name of *alpheus*. The heavily sculptured egg is ivory-white. The mature larva is dull green, profusely covered with small whitish nodules bearing short hairs. The larva rolls a leaf into a protective tent into which it retreats while not feeding. The pupa is a light straw, with a "bloom" of powdery white.

ERICHSON'S SKIPPER

Heliopetes domicella domicella (Erichson)

Plate 10, figure 30

The broad white bands across the forewings distinguish this rare species in our area. It occurs only in one presently known population, located at Parker Dam along the Colorado River in San Bernardino County. It flies in September and October. Erichson's Skipper was first discovered here in 1970 by James Scott, another example of how careful collecting (especially at times other than in the spring) may turn up new species for our fauna in the desert areas.

Foodplants: Unknown, but presumably in the Malvaceae.

Early stages (no text fig.): Unknown.

THE LARGE WHITE SKIPPER

Heliopetes ericetorum (Boisduval)

Plate 10, figures 28, 29

One of the more commonly encountered skippers of the Upper Sonoran Zone, the Large White Skipper flies throughout cismontane southern California and the higher mountains of the deserts. The flight season is April to October, apparently involving at least two broods. Males frequently may be seen patrolling along canyon bottoms. Adults come to mud or wet sand to sip moisture, and are often abundant on flowers.

Foodplants: Various species of Malvaceae, especially the shrublike mallows. The most common host is probably *Malacothamnus fasciculatus* (Nutt.) Greene.

Early stages (text fig. 72): The white egg is nearly spherical and is ribbed transversely and longitudinally, with blunt spines arising from the junctions (Comstock, 1927a). The mature larva is pale greenish yellow, with a thin greenish dorsal line and two similar lateral lines. Short hairs cover the body. The pupa is yellow-brown and is covered

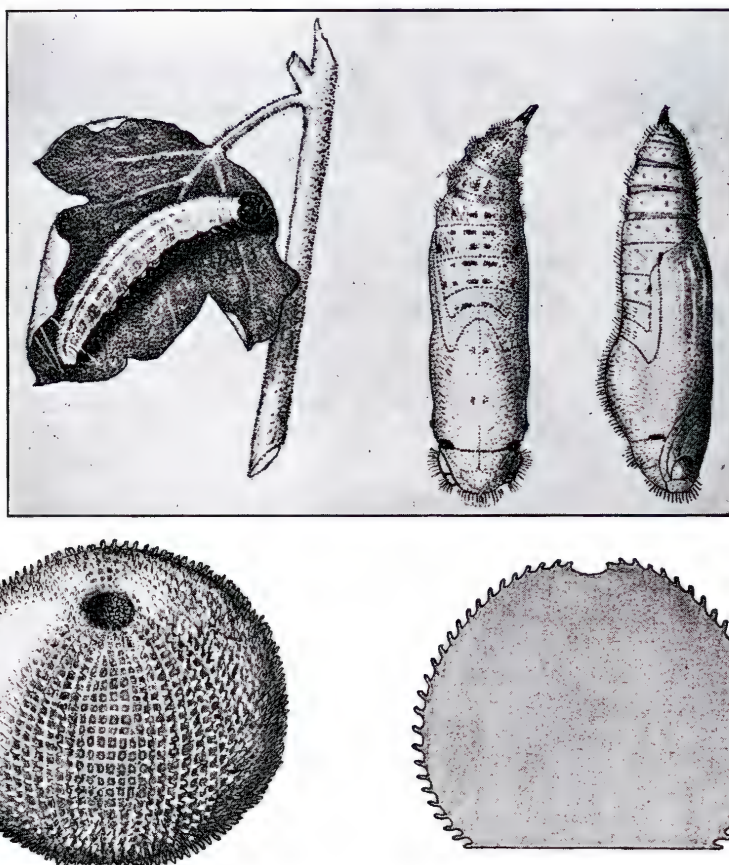


FIGURE 72. Egg, mature larva and pupa: *Heliopetes ericetorum*. (From Comstock, 1927a.)

with a bluish white powder. The cremaster and two lateral marks on the thorax are black.

THE TWO-BANDED SKIPPER

Pyrgus ruralis (Boisduval)

Plate 10, figure 31

For years, a distinct *Pyrgus* population has been known in the high meadows of the Laguna Mountains in San Diego County. It seems to be an undescribed subspecies of *Pyrgus ruralis*, although a possible affinity with *Pyrgus xanthus* Edwards is not ruled out. The adults typically fly in large open dry meadows in the ponderosa pine forest. The peak flight period is May. The foodplant here is believed to be *Horkelia bolanderi* Gray ssp. *clevelandii* (Greene) Keck (Rosaceae).

The typical dark colored subspecies, *Pyrgus ruralis ruralis* Boisduval, occurs through the Sierra Nevada in montane habitats and may possibly range into the Greenhorn Mountains. In the southern Sierra the species flies in a single brood from May to June. It is said to prefer openings within the forest rather than open meadows (Garth & Tilden,

1963). *Pyrgus ruralis* is a low-flying species and is easily overlooked.

Foodplants: *Sidalcea* (Malvaceae) and *Potentilla* (Rosaceae) are reported for Sierran populations.

Early stages (no text fig.): Undescribed, although reared by several workers.

THE SMALL CHECKERED SKIPPER

Pyrgus scriptura (Boisduval)

Plate 10, figure 32

In southern California, this small checkered skipper is found sparingly on the Colorado and Mojave deserts. It is never taken in large numbers. The distinguishing features are its smaller size, darker dorsal coloration and lighter ventral coloration. The flight period extends from March to October and involves several broods.

Foodplants: Malvaceae; the species used in our area remain to be studied. Dammers (*in litt.*) thought *Sida hederacea* (Alkali Mallow) was a probable host.

Early stages (no text fig.): Unknown.

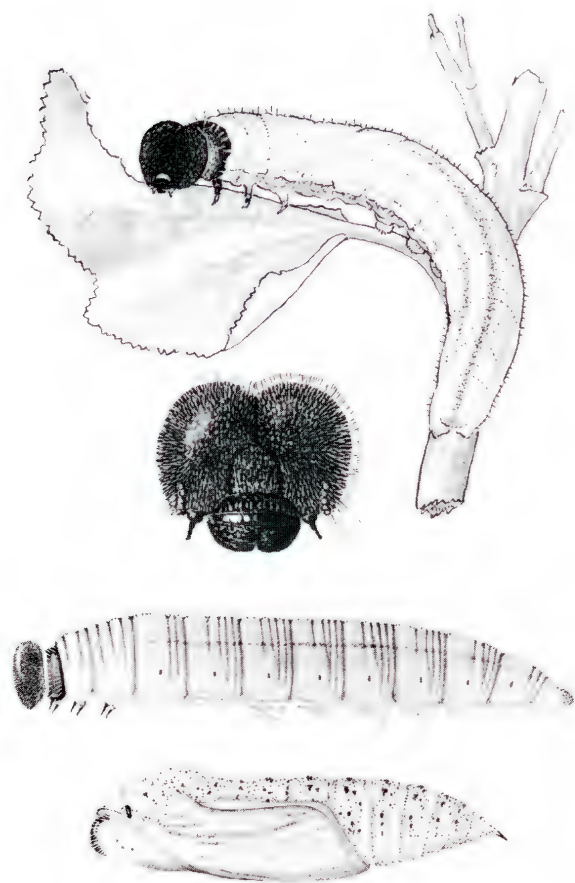


FIGURE 73. Mature larvae (insert, anterior view of head capsule) and pupa: *Pyrgus albescens*. (From Comstock, 1927 a: paintings by C. M. Dammers.)

THE WESTERN CHECKERED SKIPPER

Pyrgus albescens Plötz

Plate 10, figures 33, 34

The Western Checkered Skipper occurs throughout southern California and is especially common in the lowlands around wastelands or agricultural areas because of the prevalence of its mallow foodplants in such disturbed areas. Captures are recorded from every month of the year, but the primary flight period is February to October. There is considerable variation in degree of dark coloration, particularly in the females. In some areas of southern California, such as San Diego County, specimens are taken that resemble the other widely distributed western species of checkered skipper, *Pyrgus communis* Grote. These are slightly larger and have a darker gray ground color. Also, the tip of the valve of the male genitalia is prolonged and bidentate (two-toothed) in *P. communis* but is very short and monodont (single-toothed) in *P. albescens*. Whether these two forms are the same species, subspecies, or

distinct species is unknown, and the interesting problems involved are discussed by Tilden (1965), who aptly concludes: "There seems to be no taxonomic category that expresses their relationship precisely."

Foodplants: Malvaceae, especially species of *Malva* and *Sidalcea*. The species used in our area need to be carefully studied, especially in relation to the *P. albescens* and *P. communis* problem.

Early stages (text fig. 73): The turban-shaped egg is crossed with vertical and latitudinal ribs, and is greenish white in color. The mature larva is yellowish white, with a delicate gray-green dorsal and subdorsal line (Comstock, 1927a). Fine hairs occur over the body and head. The larva rolls a protective shelter out of the leaf on which it is feeding. The pupa is light brown or greenish brown, with many dark brown spots and stripes.

THE BRIZO DUSKYWING

Erynnis brizo (Boisduval & Le Conte)

There are six species of duskywing skippers in southern California, and were it not for the careful studies of Burns (1964) our understanding of their identification and their relationships with the rest of the genus would be discouragingly poor. They are not easy butterflies to distinguish and it may be necessary for the lepidopterist to refer to Burns' monograph for absolute determinations.

(a) BURGESS' SKIPPER

Erynnis brizo burgessi (Skinner)

Plate 10, figure 35

Erynnis brizo burgessi is found in our area only in the Providence and New York mountains of the eastern Mojave Desert. It flies in a single brood from April to early May. In Arizona the foodplants are various species of oaks.

(b) THE LACUSTRA SKIPPER

Erynnis brizo lacustra (Wright)

Plate 10, figure 36

Erynnis brizo lacustra is found in the Laguna Mountains of San Diego County, the Gavilan Hills and San Jacinto Mountains of Riverside County, the lower slopes of the San Bernardino and San Gabriel mountains, the Tehachapi and Greenhorn mountains of Kern County, and the Coast Ranges north to Lake County in northern California. The flight period of the single brood is March to June. The foodplants are evidently oaks, but have not been identified other than *Quercus durata* Jeps. being strongly suggested for central and northern California populations.

Foodplants: Oaks, *Quercus* (Fagaceae).

Early stages (no text fig.): Undescribed for our area.



FIGURE 74. Mature larvae and pupae (insert, anterior view of head capsule): *Erynnis afраниus*—left; *E. funeralis*—right. (Paintings by C. M. Dammers.)

THE AFRANIUS DUSKYWING

Erynnis afраниus (Lintner)

Plate 10, figure 37

In southern California this widely distributed western duskywing is found in the mountains of Los Angeles, southwestern San Bernardino, western Riverside, and San Diego counties. The flight period extends from March to late August and involves two broods. Burns (1964) remarks that the spring and summer broods differ in phenotype.

Foodplant: *Lotus americanus* (Nutt.) Bisch. (Spanish Clover) (Leguminosae) at Forest Home in the San Bernardino Mountains. Comstock and Dammers (1932) also report oviposition on *Ceanothus divaricatus*, but Burns (1964) feels that this second observation (at Pine Flats in upper San Gabriel Canyon) refers to another *Erynnis* species.

Early stages (text fig. 74): Described in detail by Comstock and Dammers (1932) under the name *E. persius afраниus*. The hemispherical egg is white when first laid, changing to a cream or light yellow. The surface is strongly ridged by 15 vertical ribs, which are joined by regular narrow cross-ribs. The eggs are deposited on the tender tips of the host leaves and hatch in five days. The mature larva is subcylindrical, thickest at about the sixth segment and tapering regularly toward both ends. The head is rather large, subtriangular in form, and is depressed anteroposteriorly. The ground color of the body is a pale green; a thick studding of minute raised white points (each bearing a single short white hair) gives the larva a light overcast. There is also a dark middorsal line and a thin, longitudinal yellow line running along the lateral surface. The head is black, with a covering of minute white points. Pupation occurs in a loosely spun cocoon or hibernaculum on the foodplant. The pupa is a vivid green, with a prominent black spiracle on the thorax.

THE FUNEREAL DUSKYWING

Erynnis funeralis (Scudder and Burgess)

Plate 10, figure 38

The Funereal Duskywing is the most common and widely distributed *Erynnis* in southern California. It appears as early as February and flies into October. The first brood is on the wing from February to mid April, the second brood flies from mid May until late in June, and the third generation appears in late August and September. This species is the most polyphagous of the genus and feeds on a number of legumes in the larval stages. The adults are strongly attracted to flowers.

Foodplants: Carefully documented foodplants are *Lotus scoparius* (Nutt.) Ottley; Desert Ironwood, *Olneya tesota* Gray; Colorado River Hemp, *Sesbania exaltata* (Raf.) Cory; and alfalfa, *Medicago sativa* (all in the family Leguminosae). In Chino Canyon in the western Colorado Desert (Riverside County), Coolidge observed females of the spring generation ovipositing on *Nemophila membranacea* (Hydrophyllaceae). His observations also indicated that the skipper uses *Lotus* in all three generations, and that the alfalfa host is used by members of at least the fall generation.

Early stages (text fig. 74): Described by Coolidge and by Comstock (1927a). The hemispherical egg is vertically ribbed with 12 to 16 high ridges; delicate cross-ribs occur between them. The color is at first white and gradually changes through green, yellow, and orange, to a deep brown just before hatching. The mature larva is pale green, yellowish in the folds of the body. Pale yellowish hairs cover the surface. There is a thin dark green dorsal line and a pale yellow lateral line. The ventral surface is blue. The pupa is vivid green, with yellowish white clouding on the wing cases. Pale hairs are found over the entire surface. A silken girdle is used to suspend the pupa.



FIGURE 75. Mature larva (insert, anterior view of head capsule) and pupae: *Erynnis p. propertius*—upper (pupa only); *E. t. tristis*—lower figures. (Paintings by C. M. Dammers.)

the Central Valley, also), San Gabriel, San Jacinto, and Laguna mountains, with populations also occurring in the lowlands along the coast from San Luis Obispo to Orange and San Diego counties. The species is multiple brooded throughout its range and flies from early March to September in southern California.

Foodplants: In nature, the species has been shown to feed on one introduced oak (Cork Oak) and three native species: the Coast Live Oak, *Quercus agrifolia* Nee, and the White Oaks, *Q. lobata* Nee and *Q. douglasii* H. & A. (Fagaceae) (Burns, 1964).

Early stages (text fig. 75): Described in detail by Comstock and Dammers (1932). The subspherical egg is lemon-yellow when first laid, changing later to a rich orange. There are 18 to 20 vertical ribs which are strongly defined in contrast to those of other closely related species; there are low inconspicuous cross-ribs. The eggs hatch in 5 days, after being laid singly in the terminal tender new leaves of the oak. The mature (fifth instar) larva has a bilobed orange-brown head, with three large pale orange spots on each side. It is covered with a very short colorless hairy pile. The body is pale gray-green and is covered with raised fungiform white dots, absent only on the first segment. The middorsal line is caused by the absence of the raised papillae. A thin lemon yellow lateral line extends from the third segment to the tail. Comstock and Dammers made these interesting observations on the larva's habits: "When newly emerged the larva cuts two longitudinal incisions on the tip of a tender leaf and folds back the flap thus formed, uniting the edges to the leaf, thus making a protective nest. Later it makes a nest by uniting the edges of a single leaf, or it may bring two leaves together, uniting the edges. It remains concealed throughout life, except at the time of feeding. Pupation occurs within the protective domicile." The pupa is olive gray, with much darker wing cases. The surface is covered with hairs except on the wing cases. The authors noted that there was heavy parasitism among the larvae by a small ichneumonid wasp and in a few cases by a tachinid fly.

THE ARTFUL DUSKYWING

Erynnis pacuvius callidus (Grinnell)

Plate 10, figure 39

This duskywing is distributed throughout cismontane central and southern California and into northern Baja California. It flies in the Coast Ranges from Monterey County south to the Tehachapi Mountains in Kern County, across the San Gabriel and San Bernardino Mountains but apparently not in the Santa Monica Mountains, and south through the San Jacinto Mountains of Riverside County to the Laguna Mountains of San Diego County. It has not been found in the desert ranges. In San Diego County the species is double brooded (flying from April to October); to the north, it is single brooded (late May to July).

Foodplants: *Ceanothus oliganthus* (= *C. divaricatus* of Comstock and Dammers, 1932), according to Burns (1964).

Early stages (no text fig.): Undescribed.

THE MOURNFUL DUSKYWING

Erynnis tristis tristis (Boisduval)

Plate 10, figure 40

The Mournful Duskywing is distinguished phenotypically by its lighter brown (not black) ground color, the bold white fringes on the hindwings, and no or little development of white patches on the ventral surface of the hindwing adjacent to the fringe (Burns, 1964). It is known only from California and in our area is restricted to the Coast Ranges, Tehachapi Mountains (one record at the southern end of

THE PROPERTIUS DUSKYWING

Erynnis propertius propertius (Scudder and Burgess)

Plate 10, figure 41

The Propertius Duskywing is covered with long, greatly elevated hairs, giving the adults a hairy appearance. The mixture of white and black scales gives a distinctly gray aspect to both sexes. It is widespread in California and in our region the subspecies is found along the Coast Ranges and the southern Sierra Nevada into the Transverse Ranges (Tehachapi and Greenhorn mountains), then south through

the San Gabriel, San Bernardino, San Jacinto, and Laguna mountains. It flies in the foothill canyons but is more commonly encountered at middle elevations. *Erynnis propertius* is a spring-flying butterfly, the single brood appearing from March to June.

Foodplants: Oaks throughout the Pacific Coast range of the species, but only one species has been identified from our area: *Quercus agrifolia* Nee (Fagaceae) (see Burns, 1964, for discussion).

Early stages (text fig. 75): Undescribed in the literature, but painted by Dammers.

THE POWDERED SKIPPER

Systasea evansi (Bell)

Plate 10, figure 42

This southern California species of powdered skipper was described in 1941 and replaces the old name of *S. pulverulenta* R. Felder which still applies to the species found in Texas. *Systasea evansi* is a rare find in our area, although it is relatively common in southern Arizona and parts of Baja California. Populations occur along the western edge of the Colorado Desert. Specimens have been reported (Donahue, *in litt.*) from San Felipe Valley and 1 mi W Scissors Crossing, San Diego County, and Santa Rosa Mountain and Palm Springs in the Colorado Desert portion of Riverside County. Apparently two broods occur, as specimens have been collected in February to March and again in September.

Foodplants: Unknown, although *Hibiscus denudatus* Benth. (Malvaceae) is suspected.

Early stages (no text fig.): Unknown.

THE CEOS SKIPPER

Staphylus ceos (Edwards)

Plate 10, figures 43, 44

This very black little skipper was formerly placed in the sootywing genus, *Pholisora*. It has no prominent light markings except for reddish ochraceous scaling on the dorsal surface of the head and palpi. On the ventral surface, the palpi and thorax are quite white, and two minute paired white spots occur near the apex of the forewing. It penetrates our area from Arizona, in Imperial County. Specimens have been collected there since 1930, always in the month of May.

Foodplant: Unknown.

Early stages (no text fig.): Undescribed.

THE NORTHERN DUSKYWING

Thorybes pylades (Scudder)

Plate 10, figures 45, 46

The Northern Duskywing occurs across the continent in North America. Our California populations were called *Thorybes mexicana* H. S. by Comstock (1927a), but according to skipper specialists these



FIGURE 76. Mature larva and pupa: *Thorybes pylades*. (Paintings by C. M. Dammers.)

populations are actually conspecific with the eastern *T. pylades*. It is found throughout the higher mountains of southern California. The flight period of the single brood is May to June. Adults are often taken at mud, sipping water. The males sometime hilltop.

Foodplants: Various members of the family Leguminosae. The species used in our area need investigation. Dammers indicated (*in litt.*) that one host is *Amorpha californica* Nutt. (Leguminosae).

Early stages (text fig. 76): Described for populations in southern California by Comstock and Dammers (1933), under the name of *T. mexicana*. The spherical egg bears 13 vertical ribs with less well-defined cross-ribs. Eggs are deposited singly on the foodplant and are glistening white in color. They hatch in about ten days. The mature larva is buff-orange, heavily blotched with maroon, and covered with raised buff punctae from each of which arises a single short colorless hair. A thin middorsal and a narrow lateral maroon line run from the second to the tenth body segments. The disproportionately large head is dark maroon, profusely covered with fine buff hairs. The black neck is less constricted than with other larvae of the genus. Comstock and Dammers note that the larvae pass their entire life, when not feeding, concealed in silken nests formed by uniting several leaves. They ceased feeding early in September and after shrinking noticeably went into hibernation but did not pupate. They pupated the following March, inside their leafy nests. The pupa is blackish brown, with buff wing cases. The front of the head, dorsal thorax area, and abdomen are sparsely covered with short yellow-brown hairs.



FIGURE 77. Mature larvae and pupae: *Urbanus proteus*—left; *Epargyreus c. clarus*—right. (Paintings by C. M. Dammers.)

THE LONG-TAILED SKIPPER

Urbanus proteus (Linnaeus)

Plate 10, figure 47

The Long-tailed Skipper is a widespread tropical species south of the Mexican border. It is often remarkably abundant from Arizona through Mexico and Central America, and specimens were taken by early explorers in the eighteenth century (Linnaeus named it in 1758). It also occurs in numbers in the eastern United States. In southern California, *Urbanis proteus* is sporadic throughout the lowlands and the western edge of the Colorado Desert. Its habit of using Wisteria probably accounts for populations becoming established for a few years in areas like Los Angeles, then being exterminated by a very cold winter (cold to a primarily tropical species). It flies from early summer to October.

A shorter-tailed relative, *Urbanus dorantes* Stoll, is possibly occasional in our area (see Appendix I).

Foodplants: Legumes in the family Leguminosae, including *Phaseolus* (beans), *Clitoria*, *Wisteria*, and *Prosopis* (mesquite), according to Comstock (1927a).

Early stages (text fig. 77): The mature larva is greenish, with a thin dark dorsal line and a yellow subdorsal stripe. A pale green line runs along the basal lateral area. Areas of gray, dotted with black and yellow, occur between these lines on each segment. The head is brown with a yellow spot on each side. The pupa is brown with a white powdery covering.

SKINNER'S ARIZONA SKIPPER

Polygonus leo arizonensis (Skinner)

Plate 10, figures 48, 49

This large dark brown skipper with three large white forewing spots is sporadically found in the Mojave and Colorado Deserts and into coastal San Diego County. There is also a record for Glendora in Los Angeles County. The species is usually taken as single specimens, but recently small series have been taken at Scissors Crossing (San Diego County) and the Providence Mountains of eastern San Bernardino County. It also may be resident in Imperial County. In certain years, following the fall "Santa

Ana" winds from the desert, adults are taken on *Lantana* flowers in lowland San Diego County localities, such as La Mesa and Del Mar (Shields, *in litt.*). Most specimens have been taken in August and September.

Foodplants: Unknown for our area.

Early stages (no text fig.): Undescribed.

THE SILVER-SPOTTED SKIPPER

Epargyreus clarus (Cramer)

Plate 10, figure 50

The typical race of the Silver-spotted Skipper, *E. clarus clarus* (Cramer), is a distinctive inhabitant of the San Bernardino Mountains in southern California, where it apparently has two broods, May to July and late August to late September. It has not been taken elsewhere in southern California. The San Diego County mountains apparently support other populations of *E. clarus* which have been determined by Dixon (Thorne, *in litt.*) to be the same as his Arizona subspecies, *E. clarus huachuca* Dixon. We have been unable to locate any known specimens other than those mentioned by Dixon.

Foodplants: Undetermined for our area; elsewhere, the species uses legumes such as *Wisteria*, *Robinia*, and *Amorpha*. In northern California the species commonly uses *Lotus crassifolius* (Benth.) Greene (Leguminosae), which grows in our region also. It may use *Amorpha californica* Nutt. (Leguminosae), a common plant in the San Bernardino Mountains habitat of the skipper.

Early stages (text fig. 77): The domed egg is heavily ribbed, with cross-ribs, and is leaf green, with a bright red spot at the top. The mature larva is lemon-green, banded transversely with darker green. The head is large, brownish in color, and bears two large orange spots. The larva constructs a shelter for protection during the day by binding the edges of leaves together with silk. It moves out of this shelter to feed at night. The pupa is chestnut brown, with a few darker markings. Comstock (1927a) remarks that pupation usually occurs on the ground within a loosely constructed shelter.

APPENDIX I

RARELY RECORDED SPECIES OR DOUBTFUL RECORDS

PAPILIONIDAE

1. *Papilio polyxenes asterius* Stoll

A worn female of *asterius* was taken at Ensenada, Baja California, Mexico, in August, 1955, by David Dirks, suggesting that *asterius* may occasionally stray across the border. One of us (T.C.E.) has observed black Papillos in late May at Winterhaven, Imperial County, which may be *asterius* but more probably are *P. rudkini* form "clarki."

PIERIDAE

2. *Pieris occidentalis* Reakirt

Chang (1963), separates *P. protodice* and *P. occidentalis* as distinct species. His southernmost record for *occidentalis* is Long Valley, Mono County, California, but its range undoubtedly extends farther south. It is possible that it will be found in the higher elevations of the Greenhorn Mountains.

3. *Pieris napi* (Linnaeus)

A long series of specimens of this species from Lopez Canyon, San Luis Obispo County, and collected in February and March, 1959, is in the Santa Barbara Natural History Museum. This locality is only several miles south of our arbitrary line separating southern California from the rest of the state. Other canyons just south of here should be checked for this species of white, since this area represents the southernmost extension of the range of *Pieris napi* in California.

4. *Colias alexandra* Edwards

A single yellow *Colias* was sighted in Keystone Canyon in the New York Mountains on June 1, 1968, by Bruce Griffin, which may be referable to this species. Further investigation in this poorly collected area is indicated, to determine whether *C. alexandra*, *harfordii*, or *philodice* occur as residents.

5. *Kricogonia lyside* (Godart)

Roever took a specimen of this pierid 3 miles east of Calexico, Imperial Co., on July 15, 1972. Since it closely resembles *Pieris rapae* in flight, collectors are urged to sample any "whites" they come across in the Imperial and Colorado River Valley areas in hopes of duplicating Roever's record.

6. *Euchloe ausonides* Lucas

This species may possibly extend as far south as the Greenhorn Mountains from the southern Sierra Nevada.

NYMPHALIDAE

7. *Euptoieta hegesia hoffmanni* Comstock

There is a worn specimen of this species in the Los Angeles County Museum collection labeled "Pasadena, Calif., June 1900." This could represent a stray or mislabeling. Stanford (*in litt.*) states that there are several records of strays along the Colorado River and in the Imperial Valley.

8. *Heliconius charitonius* (Linnaeus)

Shields reports that there is a sight record for this species from the Laguna Mountains, San Diego County, noted in the butterfly display cases at the San Diego Natural History Museum. We know of no other records.

LYCAENIDAE

9. *Hypaurotis crysalis* (Edwards)

Comstock included this species in his state list on the basis of three records for the southern part of California. We have not seen any of the specimens on which he based this citation. We suspect that his specimens were mislabeled, since there have been no additional records. Furthermore, the foodplant, *Quercus gambelii* Nutt., does not occur in California.

10. *Xamia xami* (Reakirt)

Opler (1966c) reports a possible record for this species in California. A single female specimen in the American Museum of Natural History (AMNH) collection is labeled as being from the Providence Mountains, San Bernardino County, and was collected on April 5, 1934, by G. H. and J. L. Sperry. Since no additional records have come to light, and the nearest *X. xami* population is near Tucson, Arizona, it is possible that the Sperry specimen was somehow accidentally mislabeled during their Arizona and California collecting trip that April.

11. *Erora quaderna* (Hewitson)

There is a specimen of this species in the collection in the Natural History Museum of Los Angeles County bearing the label data: III-22-40, Providence Mts., San Bernardino Co., California, T. B. Blevins, Jr., collector. According to Roever (1962), the Providence Mountains are an entirely different environment from that in which *quaderna* occurs in Arizona. Because the record has not been duplicated, we believe that the Blevins specimen was mislabeled.

12. *Lycaena rubidus* (Behr)

This species was reported taken near Monolith, Kern Co., in the Field Season Summary for 1950 (*The Lepidopterist's News* 4:87). If these specimens were true *rubidus*, then this represents a southern range extension from the Sierra Nevada. The species is common in the Monache Meadows area north of Monolith in Tulare County.

MEGATHYMIDAE

13. *Agathymus comstocki* (Harbison)

Probably once flew on Pt. Loma, San Diego Co., where its foodplant, *Agave shawii* Engelm. (Agavaceae), was once locally abundant. The *Agave* has become extinct there in this century from housing developments. The *Agave* and this giant skipper are now found only in Baja California.

14. *Megathymus coloradensis navajo* Skinner

Listed by Freeman (1969:15) as occurring in the Little San Bernardino Mts. of San Bernardino Co. All specimens from this area that we have examined are inseparable from topotypical *M. c. martini* Stallings and Turner.

HESPERIIDAE

15. *Nyctelius nyctelius* (Latreille)

A single specimen of this tropical skipper was taken by Oakley Shields at El Cajon, San Diego Co., in October, 1958. It was identified by C. Don MacNeill. This species is abundant in Mexico but is known from the U. S. only in the vicinity of Pharr, Texas.

16. *Calpododes ethlius* (Stoll)

There are several specimens in the collection of the Natural History Museum of Los Angeles County which suggest that this species is an occasional migrant to California. Two specimens are labelled "larva on Canna/Emgd 1905/Los Angeles, Calif.". Another is labelled "Riverside, Calif./11-XI-1942." A fourth specimen was reared from a larva found at Yuma, Arizona, by D. L. Bauer.

17. *Amblyscirtes phylace* (Edwards)

Listed by Comstock (1927) as a possible straggler into Southern California. We know of no records.

18. *Poanes hobomok* (Harris)

Evans (1955) lists this species from California. We have seen no specimens which could support this statement.

19. *Poanes zabulon* (Boisduval and Le Conte)

Ray Stanford (*in litt.*) states that there is a female of this species in the National Museum of Natural History (USNM) collection with the label "Havilah, Calif./July/Barnes Collection." We doubt its authenticity.

20. *Poanes taxiles* (Edwards)

Comstock (1927) stated that this skipper was doubtfully accredited to California. There are no California records to our knowledge.

21. *Oarisma garita* (Reakirt)

Stanford (*in litt.*) states that there are two males in the AMNH collection, one labeled "Paso Robles" and another labeled "San Joaquin Co." no collector's name on either label. These are probably both mislabeled.

22. *Piruna pirus* (Edwards)

Hulbirt (1935) reports collecting a single fresh male of this species on September 2, 1934, near Carlsbad, San Diego County, by the edge of a salt marsh. We know of no other specimens.

23. *Pholisora mejiicana* (Reakirt)

The species is occasionally reported from the state. All specimens from our area identified as this species have proved to be *P. catullus* (Fabricius).

24. *Helioptetes laviana* (Hewitson)

Tilden (*in litt.*) states that there are specimens of this species from Joshua Tree National Monument. Until this record is duplicated, we feel that these specimens were either mislabeled or representatives of one of our other two *Helioptetes* species.

25. *Erynnis juvenalis* (Fabricius)

This was listed in error by Comstock (1927) as a California resident. Burns (1964) has clarified the status and distribution of this species.

26. *Erynnis meridianus* Bell

This species may occur in the New York and Providence mountains; it has been taken in the Spring Mts. in southern Nevada, less than 40 airline mi away.

27. *Erynnis telemachus* Burns

Although described from Arizona, it is possible that this species enters California in the Providence or New York mountains, since it is often found with *E. b. burgessi* (Skinner).

28. *Achlyodes thraso tamenund* (Edwards)

Ray Stanford (*in litt.*) informs us that there is a specimen of this common Texas and Mexican species in the National Museum of Natural History collection, labeled simply "Calif." We suspect that it is mislabeled.

29. *Cogia calchas* (Herrich-Schäffer)

Stanford (*in litt.*) states that there is a single fresh male of this species in the American Museum of Natural History collection bearing the label: "Indian Wells/23-IV-23." This could easily be an authentic record, since a number of out-of-state desert species find their way into the desert areas of California as strays.

30. *Thorybes bathyllus* (Smith)

Stanford (*in litt.*) writes that a specimen in the American Museum of Natural History collection is labeled "Calif." This is likely mislabeled.

31. *Thorybes mexicana* (Herrich-Schäffer)

Comstock (1927) erroneously lists this as a California resident. The California material he ascribes to this species is *T. pylades*.

32. *Autochton cellus* (Boisduval and Le Conte)

Evans (1965) lists California as a locality for this species in his catalogue. Since we have seen no specimens from the state, the specimen on which he based this was probably mislabeled.

33. *Urbanus dorantes* (Stoll)

Stanford (*in litt.*) informs us that a specimen of this species at the National Museum of Natural History bears the label "Southern Cala/Barnes Collection." This is the only specimen we know of with a California label, and is probably mislabeled. Comstock, in referring to the same species (as *rauterbergi*), states that it "is doubtfully credited to southern California." We agree.

34. *Urbanus procne* (Plötz)

Stanford (*in litt.*) states that a single specimen of this species in the American Museum of Natural History collection bears the label "male 10-22-20/Fertilla, Calif./J. D. Gunder Collection Ac. 34998/G2273." This could easily be a valid record since it is from a poorly collected area of the state where strays from Arizona are to be expected.

35. *Epargyreus exadeus* (Cramer)

This skipper was listed by Comstock as a possible California resident. We know of no reports from the state.

APPENDIX II

CHECKLIST OF THE BUTTERFLIES OF SOUTHERN CALIFORNIA

Southern California is defined for the purposes of this publication as all of the state of California to the south of a line drawn from San Luis Obispo on the coast to Panamint Springs in the Death Valley region of eastern California. Thus the Sierran fauna, excepting the species reaching the Greenhorn Mountains, is excluded from this list.

PAPILIONIDAE

1. *Papilio zelicaon* Lucas
2. *Papilio bairdii bairdii* Edwards
 - f. "brucei" Edwards
 - f. "hollandi" Edwards
3. *Papilio rudkini* Comstock
 - f. "comstocki" Chermock & Chermock
 - f. "clarki" Chermock & Chermock
4. *Papilio indra* Reakirt
 - a. *P. i. indra* Reakirt
 - b. *P. i. pergamus* Hy. Edwards
 - c. *P. i. fordii* Comstock & Martin
 - d. *P. i. martini* Emmel & Emmel
5. *Papilio cressphontes* Cramer
6. *Papilio rutulus rutulus* Lucas
7. *Papilio eurymedon* Lucas
8. *Papilio multicaudatus* Kirby
9. *Battus philenor philenor* (Linnaeus)

PIERIDAE

10. *Neophasia menapia menapia* (Felder & Felder)
11. *Pieris beckerii* Edwards
12. *Pieris sisymbrii sisymbrii* Boisduval
13. *Pieris protodice* Boisduval & Le Conte
 - f. "vernalis" Edwards
14. *Pieris rapae* (Linnaeus)
15. *Colias eurytheme eurytheme* Boisduval
 - f. "alba" Strecker
 - f. "ariadne" Edwards
 - f. "amphidusa" Boisduval
16. *Colias philodice philodice* Godart
17. *Colias harfordii harfordii* Hy. Edwards
 - f. "barbara" Hy. Edwards
18. *Colias (Zerene) eurydice* Boisduval
 - f. "bernardino" (Edwards)
19. *Colias (Zerene) cesonia* (Stoll)
20. *Phoebis sennae marcellina* (Cramer)
21. *Phoebis agarithe agarithe* (Boisduval)
22. *Eurema mexicana* (Boisduval)
23. *Eurema nicippe* (Cramer)
24. *Nathalis iole* Boisduval
25. *Anthocharis cethura* (Felder & Felder)
 - a. *A. c. cethura* (Felder & Felder)
 - f. "deserti" Wright
 - f. "morrisoni" Edwards
 - f. "caliente" Wright
 - b. *A. c. catalina* Meadows
 - c. *A. c. pima* Edwards
26. *Anthocharis sara* Lucas
 - a. *A. s. sara* Lucas
 - f. "reakirtii" Edwards
 - f. "stella" Edwards
 - b. *A. s. thoosa* Scudder
 - c. *A. s. gunderi* Ingham
- Anthocharis sara* X *lanceolata* = hybrid f. "dammersi" Comstock
27. *Anthocharis lanceolata australis* (Grinnell)
28. *Euchloe hyantis* (Edwards)
 - a. *E. h. lotta* (Beutenmüller)
 - b. *E. h. andrewsi* Martin

- c. *E. h. Mt. Pinos* block segregate
- d. *E. h. Peninsular* ranges segregate

DANAIDAE

29. *Danaus plexippus* (Linnaeus)
30. *Danaus gilippus strigosus* (Bates)

SATYRIDAE

31. *Coenonympha californica californica* Westwood
 - f. "galactina" (Boisduval)
32. *Cercyonis sthenela* (Boisduval)
 - a. *C. s. silvestris* (Edwards)
 - b. *C. s. paulus* (Edwards)

NYMPHALIDAE

33. *Agraulis vanillae incarnata* (Riley)
34. *Euptoieta claudia* (Cramer)
35. *Speyeria adiastra* (Edwards)
 - a. *S. a. atossa* (Edwards)
 - f. "tejonica" (Comstock)
 - b. *S. a. clemencei* (Comstock)
36. *Speyeria coronis* (Behr)
 - a. *S. c. coronis* (Behr)
 - b. *S. c. hennei* (Gunder)
 - c. *S. c. semiramis* (Edwards)
37. *Speyeria hydaspe viridicornis* (Comstock)
38. *Speyeria callippe* (Boisduval)
 - a. *S. c. comstocki* (Gunder)
 - b. *S. c. macaria* (Edwards)
 - f. "laurina" (Wright)
39. *Speyeria egleis tehachapina* (Comstock)
40. *Boloria epithore sierra* Perkins
41. *Euphydryas chalcedona* (Doubleday)
 - a. *E. c. chalcedona* (Doubleday)
 - b. *E. c. quino* (Behr)
 - c. *E. c. kingstonensis* Emmel & Emmel
 - d. *E. c. corralensis* Emmel & Emmel
42. *Euphydryas editha* (Boisduval)
 - a. *E. e. editha* (Boisduval)
 - b. *E. e. nr. bayensis* Sternitzky
 - c. *E. e. augusta* (Edwards)
 - d. *E. e. wrighti* Gunder
43. *Chlosyne neumoegeni* (Skinner)
44. *Chlosyne gabbii gabbii* (Behr)
45. *Chlosyne palla* (Boisduval)
 - a. *C. p. palla* (Boisduval)
 - b. *C. p. vallismortis* (Johnson)
46. *Chlosyne leanira* (Felder & Felder)
 - a. *C. l. wrightii* (Edwards)
 - b. *C. l. cerrita* (Wright)
 - c. *C. l. near alma* (Strecker)
 - d. *C. l. daviesi* (Wind)
47. *Chlosyne lacinia crocale* (Edwards)
 - f. "nigrescens" (Cockerell)
 - f. "rufescens" (Cockerell)
48. *Chlosyne californica* (Wright)
49. *Microtia dymas imperialis* Bauer
50. *Phyciodes phaon* (Edwards)
51. *Phyciodes campestris campestris* (Behr)
52. *Phyciodes tharos* (Drury)

53. *Phyciodes mylitta mylitta* (Edwards)
54. *Polygonia satyrus satyrus* (Edwards)
f. "chrysoptera" Wright
55. *Polygonia zephyrus* (Edwards)
56. *Nymphalis antiopa antiopa* (Linnaeus)
57. *Nymphalis californica californica* (Boisduval)
58. *Nymphalis milberti furcillata* (Say)
59. *Vanessa atalanta rubria* (Fruhstorfer)
V. atalanta X *C. annabella* =
hybrid f. "edwardsi" Grinnell
60. *Cynthia cardui* (Linnaeus)
61. *Cynthia annabella* Field
f. "muelleri" (Letcher)
f. "letcheri" (Grinnell)
62. *Cynthia virginiana* (Drury)
63. *Precis coenia* (Hübner)
64. *Precis nigrosuffusa* (Barnes & McDunnough)
65. *Limenitis archippus obsoleta* Edwards
66. *Limenitis lorquini lorquini* (Boisduval)
67. *Adelpha bredowii* (Geyer)
a. *A. b. californica* (Butler)
b. *A. b. eulalia* (Doubleday)

LIBYTHEIDAE

68. *Libytheana bachmanii larvata* (Strecker)

LYCAENIDAE

RIODININAE:

69. *Apodemia mormo* (Felder & Felder)
a. *A. m. mormo* (Felder & Felder)
b. *A. m. cythera* (Edwards)
c. *A. m. virgulti* (Behr)
d. *A. m. deserti* Barnes & McDunnough
e. *A. m.* near *dialeuca* Opler & Powell
70. *Apodemia palmerii marginalis* Skinner
71. *Calephelis nemesis* (Edwards)
a. *C. n. dammersi* McAlpine
b. *C. n. californica* McAlpine
72. *Calephelis wrighti* Holland

THECLINAE:

73. *Habrodais grunus grunus* (Boisduval)
74. *Atlides halesus corcorani* Gunder
75. *Strymon avalona* (Wright)
76. *Strymon melinus pudica* (Hy. Edwards)
77. *Strymon columella istapa* (Reakirt)
78. *Chlorostyrymon simaethis saria* (Skinner)
79. *Ministrymon leda* (Edwards)
80. *Ministrymon ines* (Edwards)
81. *Satyrion californica* (Edwards)
82. *Satyrion sylvinus* (Boisduval)
a. *S. s. sylvinus* (Boisduval)
b. *S. s. desertorum* (Grinnell)
c. *S. s. dryope* (Edwards)
83. *Satyrion behrii behrii* (Edwards)
84. *Satyrion aetorum spadix* (Hy. Edwards)
85. *Satyrion tetra* (Edwards) (= *S. adenostomatis*)
86. *Satyrion saepium saepium* (Boisduval)
87. *Mitoura spinetorum* (Hewitson)
88. *Mitoura nelsoni nelsoni* (Boisduval)
89. *Mitoura siva* (Edwards)
a. *M. s. siva* (Edwards)
b. *M. s. juniperaria* Comstock
c. *M. s. mansfieldi* Tilden
90. *Mitoura loki* (Skinner)
91. *Incisalia eryphon* (Boisduval)
92. *Incisalia augustinus* (Westwood)
a. *I. a. iroides* (Boisduval)
b. *I. a.* near *annetteae* dos Passos

93. *Incisalia fotis fotis* (Strecker)
94. *Callophrys dumetorum dumetorum* (Boisduval)
95. *Callophrys comstocki* Henne

LYCAENINAE:

96. *Lycaena arota* (Boisduval)
a. *L. a. arota* (Boisduval)
b. *L. a. nubila* Comstock
97. *Lycaena hermes* (Edwards)
98. *Lycaena gorgon* (Boisduval)
99. *Lycaena xanthoides xanthoides* (Boisduval)
100. *Lycaena helloides* (Boisduval)
101. *Lycaena heteronea clara* Hy. Edwards

PLEBEJINAE:

102. *Leptotes marina* (Reakirt)
103. *Brephidium exilis* (Boisduval)
104. *Hemiargus ceraunus gyas* (Edwards)
105. *Hemiargus isola alce* (Edwards)
106. *Everes amyntula* (Boisduval)
107. *Plebejus saepiolus* (Boisduval)
a. *P. s. saepiolus* (Boisduval)
b. *P. s. hilda* (Grinnell & Grinnell)
108. *Plebejus icarioides* (Boisduval)
a. *P. i. evius* (Boisduval)
b. *P. i. moroensis* (Sternitzky)
c. *P. i.* subspecies—Argus Mts.
109. *Plebejus acmon* (Westwood & Hewitson)
a. *P. a. acmon* (Westwood & Hewitson)
b. *P. a. texanus* Goodpasture
110. *Plebejus lupini monticola* (Clemence)
111. *Plebejus neurona* (Skinner)
112. *Plebejus emigdionis* (Grinnell)
113. *Plebejus melissa inyoensis* (Gunder)
114. *Philotes battoides* (Behr)
a. *P. b. bernardino* Barnes & McDunnough
b. *P. b. martini* Mattoni
c. *P. b.* subspecies—El Segundo Dunes population.
d. *P. b.* subspecies—Providence & Clark mtns.,
flying in Sept. & Oct.
e. *P. b.* subspecies—Tehachapi Mts.
115. *Philotes enoptes* (Boisduval)
a. *P. e. dammersi* Comstock & Henne
b. *P. e. tildeni* Langston
c. *P. e.* near typical *enoptes*—Mt. Pinos—Tehachapi—north slope San Gabriel Mtns. segregate.
d. *P. e.* near *smithi* Mattoni—Ojai & Santa Paula in Ventura Co.
e. *P. e.* subspecies—near Cima, San Bernardino Co.
116. *Philotes rita elvirae* Mattoni
117. *Philotes mojave* Watson & Comstock
118. *Philotes speciosa* (Hy. Edwards)
119. *Philotes sonorensis* (Felder & Felder)
f. "comstocki" Gunder
120. *Glauropsyche piasus* (Boisduval)
a. *G. p. piasus* (Boisduval)
b. *G. p. sagittigera* (Felder & Felder)
121. *Glauropsyche lygdamus* (Doubleday)
a. *G. l. australis* Grinnell
b. *G. l.* subspecies—eastern Mojave Desert
122. *Celastrina argiolus* (Linnaeus)
a. *C. a. echo* (Edwards)
b. *C. a. cinerea* (Edwards)

MEGATHYMIDAE

123. *Agathymus stephensi* (Skinner)

124. *Agathymus alliae* (Stallings & Turner) subspecies—
eastern Mojave Desert
125. *Agathymus baueri* (Stallings & Turner) subspecies—
eastern Mojave Desert
126. *Megathymus coloradensis* Riley
a. *M. c. martini* Stallings & Turner
b. *M. c. maudae* Stallings, Turner & Stallings
c. *M. c.* subspecies—coastal San Diego County

HESPERIIDAE

127. *Panoquina panoquinoides errans* (Skinner)
128. *Lerodea eufala* (Edwards)
129. *Euphyes vestris* (Boisduval)
130. *Paratrytone melane* (Edwards)
131. *Ochlodes sylvanoides sylvanoides* (Boisduval)
132. *Ochlodes agricola* (Boisduval)
a. *O. a. agricola* (Boisduval)
b. *O. a. nemorum* (Boisduval)
c. *O. a. verus* (Edwards)
133. *Ochlodes yuma yuma* (Edwards)
134. *Atalopedes campestris* (Boisduval)
135. *Polites sabuleti* (Boisduval)
a. *P. s. sabuleti* (Boisduval)
b. *P. s. chusca* (Edwards)
136. *Polites sonora sonora* (Scudder)
137. *Hesperia harpalus* (Edwards)
a. *H. h. yosemite* Leussler
b. *H. h. harpalus* (Edwards)
c. *H. h. leussleri* Lindsey
d. *H. h.* Tehachapi blend zone population
138. *Hesperia lindseyi* Holland
139. *Hesperia columbia* (Scudder)
140. *Hesperia pahaska martini* MacNeill
141. *Hesperia juba* (Scudder)
142. *Pseudocopaodes eunus* (Edwards)
143. *Yvretta carus* (Edwards)
144. *Hylephila phyleus* (Drury)
145. *Copaodes aurantiaca* (Hewitson)
146. *Nastra julia* (Freeman)
147. *Pholisora catullus* (Fabricius)
148. *Pholisora libya* (Scudder)
a. *P. l. libya* (Scudder)
b. *P. l. lena* (Edwards)
c. *P. l.* subspecies—so. San Joaquin Valley
149. *Pholisora alpheus oricus* Edwards
150. *Pholisora graciellae* MacNeill
151. *Heliopetes domicella domicella* (Erichson)
152. *Heliopetes ericetorum* (Boisduval)
153. *Pyrgus ruralis* (Boisduval)
154. *Pyrgus scriptura* (Boisduval)
155. *Pyrgus albescens* Plötz
156. *Erynnis brizo* (Boisduval and Le Conte)
a. *E. b. burgessi* (Skinner)
b. *E. b. lacustra* (Wright)
157. *Erynnis afranius* (Lintner)
158. *Erynnis funeralis* (Scudder and Burgess)
159. *Erynnis pacuvius callidus* (Grinnell)
160. *Erynnis tristis tristis* (Boisduval)
161. *Erynnis propertius propertius* (Scudder and Burgess)
162. *Systasea evansi* (Bell)
163. *Staphylus ceos* (Edwards)
164. *Thorybes pylades* (Scudder)
165. *Urbanus proteus* (Linnaeus)
166. *Polygonus leo arizonensis* (Skinner)
167. *Epargyreus clarus* (Cramer)
a. *E. c. clarus* (Cramer)
b. *E. c. huachuca* (Dixon)

LITERATURE CITED

- This is not an exhaustive list of life history references; complete citations would run to several hundred entries. If no literature is cited in the text account of a life history, this means the life history of the species is generally known and described in several major publications (e.g., Comstock, 1927; Davenport and Dethier, 1937; and Tietz, 1972).
- BAUER, D. L. 1958. A new subspecies of *Microtia dymas* (Nymphalidae) from southern California. *Lepid. News* 12:97-100.
- . 1961. The genus *Chlosyne* Butler. In Ehrlich, P. R. and A. H. Ehrlich, How to know the butterflies. W. C. Brown Co., Dubuque, Iowa. 262 pp.
- BROWER, L. P. 1958. Larval foodplant specificity in butterflies of the *Papilio glaucus* group. *Lepid. News* 12:103-114.
- . 1959. Speciation in butterflies of the *Papilio glaucus* group. II. Ecological relationships and inter-specific sexual behavior. *Evolution* 13: 212-228.
- BROWN, F. M. 1971. The "Arrowhead Blue," *Glaucopsyche piasus* Boisduval (Lycaenidae: Plebejinae). *J. Lepid. Soc.* 25: 240-246.
- . 1972. *Pseudophilotes* Beuret, 1958. *J. Lepid. Soc.* 26: 111.
- BURNS, J. M. 1964. Evolution in the skipper butterflies of the genus *Erynnis*. *Univ. Calif. Publ. Entomol.* 37: 1-214.
- CHANG, V. C. S. 1963. Quantitative analysis of certain wing and genitalia characters of *Pieris* in western North America. *J. Res. Lepid.* 2: 97-125.
- COMSTOCK, J. A. 1927a. *Butterflies of California*. Priv. publ., Los Angeles, California. 334 pp., 63 pls.
- . 1927b. Studies in Pacific Coast Lepidoptera (continued). *Bull. So. Calif. Acad. Sci.* 26: 68, 70.
- . 1928a. Studies in Pacific Coast Lepidoptera (continued). *Bull. So. Calif. Acad. Sci.* 27: 63-66.
- . 1928b. Studies in Pacific Coast Lepidoptera (continued). *Bull. So. Calif. Acad. Sci.* 27: 80-82.
- . 1929a. The egg of *Glaucopsyche lygdamus australis* Grinnell. *Bull. So. Calif. Acad. Sci.* 28: 6, 11.
- . 1929b. Studies in Pacific Coast Lepidoptera (continued). *Bull. So. Calif. Acad. Sci.* 28: 22-32.
- . 1930. Studies in Pacific Coast Lepidoptera (continued). *Bull. So. Calif. Acad. Sci.* 29: 15-19.
- . 1931. Studies in Pacific Coast Lepidoptera (continued). *Bull. So. Calif. Acad. Sci.* 30: 88-92.
- . 1956. Notes on metamorphoses of the giant skippers (Lepidoptera; Megathymidae) and the life history of an Arizona species. *Bull. So. Calif. Acad. Sci.* 55: 19-22.
- . 1966. Life history of *Philotes mojave* (Lepidoptera: Lycaeninae). *Trans. San Diego Soc. Nat. Hist.* 14: 133-136.
- , AND C. COOLIDGE. 1930. The life history of *Philotes sonorensis* Felder. *Bull. So. Calif. Acad. Sci.* 29: 17-21.
- , AND C. M. DAMMERS. 1932. Metamorphoses of five California diurnals (Lepidoptera). *Bull. So. Calif. Acad. Sci.* 31: 33-45.
- . 1933. Notes on the life histories of four Californian lepidopterous insects. *Bull. So. Calif. Acad. Sci.* 32: 77-83.
- . 1934. Additional notes on the early stages of California Lepidoptera. *Bull. So. Calif. Acad. Sci.* 33: 25-34.
- . 1935a. Notes on the early stages of two butterflies and one moth. *Bull. So. Calif. Acad. Sci.* 34: 81-87.
- . 1935b. Notes on the early stages of three butterflies and six moths from California. *Bull. So. Calif. Acad. Sci.* 34: 120-141.
- . 1935c. Notes on the life histories of three butterflies and three moths from California. *Bull. So. Calif. Acad. Sci.* 34: 211-225.
- . 1938. Notes on the metamorphosis of *Mitoura spinetorum* Hew. (Lepidoptera, Theclinae). *Bull. So. Calif. Acad. Sci.* 37: 30-32.
- , AND C. HENNE. 1965. Notes on the life history of *Philotes enoptes dammersi*. *Bull. So. Calif. Acad. Sci.* 64: 153-156.
- . 1967. Notes on the life history of *Philotes rita elvirae* (Lepidoptera; Lycaenidae). *Bull. So. Calif. Acad. Sci.* 66: 99-102.
- , AND L. M. MARTIN. 1955. A new *Papilio* from California. *Bull. So. Calif. Acad. Sci.* 54: 142-150.
- COOLIDGE, K. R. 1924. The life history of *Mitoura loki* Skinner (Lepid.: Lycaenidae). *Entomol. News* 35: 199-204.
- DAVENPORT, D., AND V. G. DETHIER. 1937. Bibliography of the described life-histories of the Rhopalocera of America north of Mexico 1889-1937. *Entomol. Amer.* 17: 155-194.
- DOS PASSOS, C. F. 1964. A synonymic list of the Nearctic Rhopalocera. *Mem. Lepid. Soc.* 1: 1-145.
- DRUMMOND, B. A., G. L. BUSH, AND T. C. EMMEL. 1970. The biology and laboratory culture of *Chlosyne lacinia* Geyer (Nymphalidae). *J. Lepid. Soc.* 24: 135-142.
- EMMEL, J. F., AND T. C. EMMEL. 1963a. Field observations on the rare argynnid, *Speyeria egleis tehachapina*. *J. Lepid. Soc.* 17: 243-244.
- . 1963b. Larval food-plant records for six western Papilios. *J. Res. Lepid.* 1: 191-193.
- EMMEL, T. C. 1969. Taxonomy, distribution and biology of the genus *Cercyonis* (Satyridae). I. Characteristics of the genus. *J. Lepid. Soc.* 23: 165-175.
- , AND J. F. EMMEL. 1968. Life history notes on *Satyrrium sylvinus dryope* Edwards (Lycaenidae: Theclinae). *J. Res. Lepid.* 7: 123-125.
- . 1973. Two new subspecies of *Euphydryas chalcedona* from the Mojave Desert of southern California. *J. Res. Lepid.* 11: 141-146.
- EVANS, W. H. 1952. Notes on *Anthocharis sara* and *reakirtii*. *Lepid. News* 6: 106.
- . 1955. A catalogue of the American Hesperidae indicating the classification and nomenclature adopted in the British Museum. Part IV. Hesperinae and Megathyminae. British Museum (Nat. Hist.) London. 449 pp.
- FIELD, W. D. 1971. Butterflies of the genus *Vanessa* and of resurrected genera *Bassarid* and *Cynthia* (Lepidop-

- tera: Nymphalidae). *Smithsonian Contrib. Zool.* 84: 105 pp.
- FREEMAN, H. A. 1969. Systematic review of the Megathymidae. *J. Lepid. Soc.* (Suppl. 1). 59 pp.
- GARTH, J. S., AND J. W. TILDEN. 1963. Yosemite butterflies: an ecological survey of the butterflies of the Yosemite sector of the Sierra Nevada, California. *J. Res. Lepid.* 2: 1-96.
- GUNDER, J. D. 1930. The butterflies of Los Angeles County, California. *Bull. So. Calif. Acad. Sci.* 29: 1-59.
- HARDY, G. A. 1959. On the life history of *Incisalia eryphon* (Lycaenidae) on southern Vancouver Island. *J. Lepid. Soc.* 13: 70.
- HEITZMAN, J. R. 1964. The early stages of *Euphyes vestris*. *J. Res. Lepid.* 3: 151-153.
- HIGGINS, L. G. 1960. A revision of the Melitaeinae genus *Chlosyne* and allied species (Lepidoptera: Nymphalidae). *Trans. Royal Entomol. Soc. London* 112: 381-475.
- HOVANITZ, W. 1951. The biology of *Colias* butterflies. III. Variation of adult flight in the Arctic and Subarctic. *Wasmann J. Biol.* 9: 1-9.
- . 1962. The distribution of the species of the genus *Pieris* in North America. *J. Res. Lepid.* 1: 73-83.
- HULBIRT, E. R. 1935. Two unusual butterflies taken in southern California. *Bull. So. Calif. Acad. Sci.* 34: 210.
- LANGSTON, R. L. 1963. *Philotes* of central coastal California (Lycaenidae). *J. Lepid. Soc.* 17: 201-223.
- . 1965. Distribution and hosts of five *Philotes* in California (Lycaenidae). *J. Lepid. Soc.* 19: 95-102.
- . 1969a. *Philotes* of North America: synonymic list and distribution (Lycaenidae). *J. Lepid. Soc.* 23: 49-62.
- . 1969b. A review of *Glaucopsyche*, the silvery blues, in California (Lycaenidae). *J. Lepid. Soc.* 23: 149-154.
- MACNEILL, C. D. 1964. The skippers of the genus *Hesperia* in western North America. *Univ. Calif. Publ. Entomol.* 35: 1-230.
- . 1970. A new *Pholisora* with notes on *P. alpheus* (Edw.) (Lepidoptera: Hesperidae). *Entomol. News* 81: 177-184.
- MCALPINE, W. S. 1971. A revision of the butterfly genus *Calephelis* (Riodinidae). *J. Res. Lepid.* 10: 1-125.
- MARTIN, L. M. 1936. A new southern race of *Euchloe ausonides* (diurnal Lepidoptera). *Bull. So. Calif. Acad. Sci.* 35: 94-95.
- MATTONI, R. H. T. 1966. Distribution and pattern of variation in *Philotes rita*. *J. Res. Lepid.* 4: 81-102 ("1965").
- MEADOWS, D. 1936. An annotated list of the Lepidoptera of Santa Catalina Island, California. *Bull. So. Calif. Acad. Sci.* 35: 175-180.
- NECK, R. W., G. L. BUSH, AND B. A. DRUMMOND III. 1971. Epistasis, associated lethals and brood effect in larval colour polymorphism of the patch butterfly, *Chlosyne lacinia*. *Heredity* 26: 73-84.
- OPLER, P. A. 1966a. Studies on the Nearctic *Euchloe*: Part 3. Complete synonymical treatment. *J. Res. Lepid.* 5: 185-190.
- . 1966b. Studies on the Nearctic *Euchloe*: Part 4. Type data and type locality restrictions. *J. Res. Lepid.* 5: 190-195.
- . 1966c. A possible record for the occurrence of *Callophrys (Xamia) xami* (Lycaenidae) in California. *J. Lepid. Soc.* 20: 212.
- . 1967. New host plant records for *Anthocharis* (Pieridae). *J. Lepid. Soc.* 21: 212.
- . 1968. Studies on the Nearctic *Euchloe*: Part 5. Distribution. *J. Res. Lepid.* 7: 65-86.
- . 1969. Studies on the Nearctic *Euchloe*: Part 6. Systematics of adults. *J. Res. Lepid.* 8: 153-168.
- , AND J. A. POWELL. 1961. Taxonomic and distributional studies on the western components of the *Apodemia mormo* complex (Riodinidae). *J. Lepid. Soc.* 15: 145-171.
- PERKINS, E. M., AND S. F. PERKINS. 1966. A new race and discussion of the *Boloria epithore* complex (Nymphalidae). *J. Lepid. Soc.* 20: 103-117.
- PERKINS, E. M. AND W. C. MEYER. 1973. Revision of the *Boloria epithore* complex, with description of two new subspecies (Nymphalidae). *Bull. Allyn Museum* 11: 1-23.
- POWELL, J. A. 1957. A previously unrecorded host plant for *Pieris beckeri* Edwards (Lepidoptera: Pieridae). *Pan-Pacific Entomol.* 33: 156.
- ROEVER, K. 1962. Notes on *Erora* (Lycaenidae). *J. Lepid. Soc.* 16: 1-4.
- SETTE, O. E. 1962. Variation in the silvering of *Argynnis (Speyeria) callippe* in the interior mountain area of south central California. *J. Res. Lepid.* 1: 3-20.
- SHIELDS, O. 1965. *Callophrys (Mitoura) spinetorum* and *C. (M.) johnsoni*: Their known range, habits, variation, and history. *J. Res. Lepid.* 4: 233-250.
- . 1967. An ecological study of summit congregation behavior of butterflies on a southern California hill. *J. Res. Lepid.* 6: 71-178.
- , J. F. EMMEL, AND D. E. BREEDLOVE. 1969. Butterfly larval foodplant records and a procedure for reporting foodplants. *J. Res. Lepid.* 8: 21-36.
- THORNE, F. 1961. Extensions of range and a new host plant of *Philotes speciosa* (Lepidoptera: Lycaenidae). *Bull. So. Calif. Acad. Sci.* 60: 37-39.
- . 1962. Larval notes on *Chlosyne lacinia* and *C. californica*. *J. Lepid. Soc.* 16: 61.
- . 1963. The distribution of an endemic butterfly, *Lycaena hermes*. *J. Res. Lepid.* 2: 143-150.
- TIETZ, H. M. 1972. An index to the described life histories, early stages and hosts of the macrolepidoptera of the continental United States and Canada. Vols. 1 and 2. A. C. Allyn, Sarasota, Fla. 1041 pp.
- TILDEN, J. W. 1957a. A record of *Stanleya* as a food plant of *Pieris beckeri* (Lepidoptera: Pieridae). *Pan-Pacific Entomol.* 33: 169.
- . 1957b. Taxonomic history and distribution of *Ochlodes yuma* (Hesperidae). *Lepid. News* 11: 151-152.
- . 1962. General characteristics of the movements of *Vanessa cardui* (L.). *J. Res. Lepid.* 1: 43-49.
- . 1965. A note on *Pyrgus communis* and *Pyrgus albescens* (Hesperidae). *J. Lepid. Soc.* 19: 91-94.
- . 1971. Comments on the nearctic members of the genus *Precis* Huebner. *J. Res. Lepid.* 9: 101-108 ("1970").
- WIND, R. G. 1947. A new subspecies of *Melitaea* (Lepidoptera). *Pan-Pacific Entomol.* 23: 171.

EXPLANATION OF PLATE I

1. *Papilio rudkini* f. "clarki", ♂, Ivanpah Mts, San Bernardino Co, ex pupa May 2, 1935, paratype. Text Page 10
2. *P. rudkini* f. "clarki", ♀, Ivanpah Mts, San Bernardino Co, ex pupa May 2, 1935, paratype. Text Page 10
3. *P. rudkini*, ♀, Ivanpah Mts, San Bernardino Co, ex pupa February 22, 1935, paratype. Text Page 10
4. *P. zelicaon*, ♂, Topanga, Los Angeles Co, June 10, 1957, leg. H. Notman. Text Page 9
5. *P. indra martini*, ♂, Bonanza King Mine Canyon, Providence Mts, San Bernardino Co, ex larva May 28, 1965, leg. J. F. Emmel & T. C. Emmel. Text Page 13
6. *P. rudkini* f. "comstocki", ♀, Ivanpah Mts, San Bernardino Co, ex pupa October 1, 1935, paratype. Text Page 10
7. *P. bairdii bairdii*, ♂, Seven Oaks Resort, San Bernardino Mts, ex ovum July 5, 1966, leg. George Crouchet. Text Page 10
8. *P. bairdii bairdii*, ♀, Barton Flats, San Bernardino Mts, August 7, 1957, leg. C. Henne. Text Page 10
9. *P. bairdii bairdii* f. "brucei", ♂, Barton Flats, San Bernardino Mts, no date, emerged December, 1969, leg. Bruce Griffin (Griffin collection). Text Page 10
10. *P. indra fordi*, ♀, Wall Street Canyon, 2500', Calico Mts, San Bernardino Co, March 18, 1962, leg. J. F. Emmel. Text Page 12
11. *P. indra pergamus*, ♂, Idyllwild, Riverside Co, ex larva June 9, 1966, leg. J. F. Emmel. Text Page 11
12. *P. cresphontes*, ♂, Madera Canyon, Santa Rita Mts, Arizona, July 27, 1947, leg. J. A. Comstock & L. M. Martin. Text Page 13
13. *P. eurymedon*, ♂, Topanga, Los Angeles Co, May 29, 1955, leg. H. Notman. Text Page 15
14. *P. multicaudatus*, ♂, Water Canyon, Tehachapi Mts, June 16, 1964, leg. J. F. Emmel. Text Page 15
15. *Battus philenor philenor*, ♂, Scissors Crossing, San Diego Co, ex ovum ex female September 4, 1967, leg. Fred Thorne (Thorne collection). Text Page 15
16. *Papilio rutulus*, ♂, Bouquet Canyon, Los Angeles Co, May 1, 1960, leg. J. F. Emmel. Text Page 14



EXPLANATION OF PLATE 2

1. *Neophasia menapia menapia*, ♂, Tehachapi, Kern Co, July 9, 1918, leg. J. Comstock. Text Page 16
2. *N. menapia menapia*, ♀, Tehachapi, Kern Co, July 9, 1918, leg. J. Comstock. Text Page 16
3. *Pieris beckerii*, ♂, Bouquet Canyon, Los Angeles Co, May 1, 1960, leg. J. F. Emmel. Text Page 16
4. *P. beckerii*, ♀, Sweetwater Reservoir, San Diego Co, December 25, 1957, leg. O. Shields. Text Page 16
5. *P. sisymbrii*, ♂, 1 mile west of Scissors Crossing, San Diego Co, June 12, 1958, leg. O. Shields. Text Page 17
6. *P. sisymbrii*, ♀, 1 mile west of Scissors Crossing, San Diego Co, March 29, 1958, leg. O. Shields. Text Page 17
7. *P. protodice* f. "vernalis", ♂, Yaqui Wells, S. of Borrego, San Diego Co, January 4, 1958, leg. O. Shields. Text Page 17
8. *P. protodice* f. "vernalis", ♀, El Cajon, San Diego Co, February 22, 1958, leg. O. Shields. Text Page 17
9. *P. protodice*, ♂, Topanga, Los Angeles Co, June 6, 1960, leg. H. Notman. Text Page 17
10. *P. protodice*, ♀, Topanga, Los Angeles Co, October 27, 1957, leg. H. Notman. Text Page 17
11. *P. rapae*, ♂, Los Angeles, October 23, 1942. Text Page 17
12. *P. rapae*, ♀, Los Angeles, October 29, 1942. Text Page 17
13. *Colias eurytheme eurytheme*, ♂, Perris, Riverside Co, August 15, 1954, leg. T. M. Blackman. Text Page 18
14. *C. eurytheme eurytheme*, ♀, Perris, Riverside Co, September 3, 1954, leg. T. M. Blackman. Text Page 18
15. *C. eurytheme eurytheme* f. "alba", ♀, Dehesa, San Diego Co, January 19, 1958, leg. O. Shields. Text Page 18
16. *C. philodice philodice*, ♂, Milwaukee, Wisconsin, September 3, 1913, leg. H. M. Bower. Text Page 18
17. *C. philodice philodice*, ♀, Ramford, Maine, June 17, 1932. Text Page 18
18. *C. harfordii*, spring form, ♂, 1 mile west of Scissors Crossing, San Diego Co, March 6, 1960, leg. O. Shields. Text Page 19
19. *C. harfordii*, ♂, Tehachapi, Kern Co, July 7, 1918, leg. J. Comstock. Text Page 19
20. *C. harfordii*, ♀, Ridge Route, Tejon Range, June 21, 1923, leg. J. Comstock. Text Page 19
21. *C. eurydice*, ♂, near Big Bear Lake, San Bernardino Mts, August 30, 1957. Text Page 20
22. *C. eurydice*, ♀, Dehesa, San Diego Co, July 27, 1957, leg. D. Dirks. Text Page 20
23. *C. eurydice*, ♀, Forest Home, San Bernardino Mts, June 23, 1938, leg. J. Winglinger. Text Page 20
24. *Phoebis sennae marcellina*, ♀, Los Angeles, no date. Text Page 20
25. *Colias cesonia*, ♂, Palm Springs, Riverside Co, November 3, 1929, leg. C. M. Dammers. Text Page 20
26. *C. cesonia*, ♀, Gavilan Hills, Riverside Co, June 16, 1931, leg. C. M. Dammers. Text Page 20
27. *Phoebis sennae marcellina*, ♂, Riverside, September 29, 1931, leg. C. M. Dammers. Text Page 20
28. *P. sennae marcellina*, albinic, ♀, Los Angeles, August 24, 1927. Text Page 20
29. *P. agarithe agarithe*, ♀, Beeville, Texas, August 12, 1916. Text Page 21
30. *P. agarithe agarithe*, ♂, Miami, Florida, November 19, 1917. Text Page 21
31. *Eurema mexicana*, ♂, Boiling Springs, Laguna Mts, San Diego Co, May 6, 1962, leg. O. Shields. Text Page 21
32. *E. mexicana*, ♀, Topanga, Los Angeles Co, October 28, 1955, leg. H. Notman. Text Page 21
33. *Nathalis iole*, ♂, Pinyon Flat, San Jacinto Mts, Riverside Co, July 3, 1932, leg. C. M. Dammers. Text Page 22
34. *N. iole*, ♀, Palomar Mts., San Diego Co, May 17, 1958, leg. O. Shields. Text Page 22
35. *Eurema nicippe*, ♂, Los Angeles, August 7, 1959, leg. J. Emmel. Text Page 21
36. *E. nicippe*, ♀, Los Angeles, August 20, 1961, leg. J. Emmel. Text Page 21
37. *Anthocharis cethura cethura*, ♂, Scissors Crossing, San Diego Co, March 29, 1958, leg. O. Shields. Text Page 22
38. *A. cethura cethura*, ♀, Scissors Crossing, San Diego Co, February 1, 1958, leg. O. Shields. Text Page 22
39. *A. cethura cethura* f. "morrisoni", ♂, Bob's Gap, near Valyermo, Los Angeles Co, February 18, 1964, leg. N. McFarland. Text Page 22
40. *A. cethura cethura* f. "caliente", ♂, Mason Valley, San Diego Co, March 6, 1937, leg. L. M. Martin. Text Page 22
41. *A. cethura cethura* f. "deserti", ♀, Perris, Riverside Co, April 11, 1954, leg. T. M. Blackman. Text Page 22
42. *A. cethura pima*, ♂, New York Mts., San Bernardino Co, April 5, 1937, leg. R. Andrews & L. M. Martin. Text Page 22
43. *A. cethura pima*, ♀, New York Mts., San Bernardino Co, April 5, 1937, leg. R. Andrews & L. M. Martin. Text Page 22
44. *A. cethura catalina*, ♂, Grand Canyon, Santa Catalina Island, Los Angeles Co, April 9, 1933, leg. Don Meadows, holotype. Text Page 22
45. *A. cethura catalina*, ♀, Little Harbor, Santa Catalina Island, Los Angeles Co, March 11, 1928, allotype. Text Page 22







EXPLANATION OF PLATE 3

1. *Anthocharis sara sara* f. "reakirtii", ♂, Elysian Park, Los Angeles, March 2, 1910, leg. F. Grinnell. Text Page 23
2. *A. sara sara* f. "reakirtii", ♀, Little Rock Dam, Los Angeles Co, March 26, 1960, leg. J. Emmel. Text Page 23
3. *A. sara sara*, ♂, Topanga, Los Angeles Co, May 14, 1956, Leg. H. Notman. Text Page 23
4. *A. sara sara*, ♀, Topanga, Los Angeles Co, May 15, 1955, leg. H. Notman. Text Page 23
5. *A. sara thoosa*, ♀, near Mitchell Caverns State Park, Providence Mts, San Bernardino Co, April 13, 1963, leg. O. Shields. Text Page 23
6. *A. sara thoosa*, ♂, underside, Bonanza King Mine, Providence Mts, San Bernardino, April 16, 1938, leg. Don Meadows. Text Page 23
7. *A. sara sara* f. "stella", ♀, Carbon Canyon, Santa Monica Mts, Los Angeles Co, May 13-14, 1935, leg. L. M. Martin. Text Page 23
8. *A. sara gunderi*, ♂, Avalon, Santa Catalina Island, Los Angeles Co, March 30, 1932. Text Page 23
9. *A. sara gunderi*, ♀, Santa Catalina Island, Los Angeles Co, February 26, 1941, leg. L. M. Martin. Text Page 23
10. *A. lanceolata australis*, ♂, 1 mile west of Scissors Crossing, San Diego Co, February 1, 1958, leg. O. Shields. Text Page 24
11. *A. lanceolata australis*, ♂, underside, Millards Canyon, above Pasadena, Los Angeles Co, March 15, 1925, leg. J. Comstock. Text Page 24
12. *Euchloe hyantis* (Mt Pinos Block segregate), ♂, Frazier Park, Kern Co, May 5, 1962, Leg. J. Emmel. Text Page 24
13. *E. hyantis lotta*, ♂, Littlerock Dam, Los Angeles Co, March 26, 1960, leg. J. Emmel. Text Page 24
14. *E. hyantis lotta*, ♀, underside, Bob's Gap, near Valermo, Los Angeles Co, February 18, 1964, leg. N. McFarland. Text Page 24
15. *Cercyonis sthenele silvestris*, ♂, Mt Pinos, Kern Co, June 13, 1904, leg. F. Grinnell. Text Page 27
16. *C. sthenele silvestris*, ♀, 5 miles N. of Beverly Hills, Santa Monica Mts, Los Angeles Co, August 6, 1956, leg. N. McFarland. Text Page 27
17. *Euchloe hyantis* (Peninsular ranges segregate), ♀, 3 miles W. of Jacumba, San Diego Co, March 20, 1960, leg. O. Shields. Text Page 24
18. *E. hyantis* (Peninsular ranges segregate), ♂, underside, 1 mile W. of Scissors Crossing, San Diego Co, March 1, 1958, leg. O. Shields. Text Page 24
19. *E. hyantis andrewsi*, ♂, Crest Line Highway, near Lake Arrowhead, San Bernardino Co, June 10, 1936, leg. L. M. Martin, paratype. Text Page 24
20. *E. hyantis andrewsi*, ♀, Crest Line Highway, near Lake Arrowhead, San Bernardino Co, June 10, 1936, leg. L. M. Martin, paratype. Text Page 24
21. *E. hyantis andrewsi*, ♂, underside, San Bernardino Mts, May 8, 1947, leg. R. Reid. Text Page 24
22. *Cercyonis sthenele paulus*, ♀, underside, Mountain Springs Canyon, Argus Mts, Inyo Co, July 14, 1937, leg. C. N. Rudkin. Text Page 27
23. *Coenonympha californica californica*, ♂, San Miguel Mt, San Diego Co, April 11, 1959, leg. O. Shields. Text Page 26
24. *C. californica californica*, ♀, Topanga, Los Angeles Co, May 14, 1957, leg. H. Notman. Text Page 26
25. *C. californica californica* f. "galactina", ♀, underside, La Canada, Los Angeles, July 15, 1909, Leg. F. Grinnell. Text Page 26
26. *Danaus gilippus strigosus*, ♂, Riverside, October 4, 1935, leg. C. Dammers. Text Page 26
27. *D. plexippus*, ♂, 5 miles No. of Beverly Hills, Santa Monica Mts, Los Angeles Co, emerged July 19, 1956, leg. N. McFarland. Text Page 25
28. *Agraulis vanillae incarnata*, ♀, Upland, San Bernardino Co, October 7, 1957, leg. T. M. Blackman. Text Page 28
29. *Speyeria adiaspe atossa*, ♂, near Sandberg's, Ridge Route, Los Angeles Co, June 10, 1922, leg. J. Comstock. Text Page 29
30. *S. adiaspe atossa*, ♀, underside, near Sandberg's, Ridge Route, Los Angeles Co, June 10, 1922, leg. J. Comstock. Text Page 29
31. *S. adiaspe clemencei*, ♂, Atascadero, San Luis Obispo Co, May 28, 1947, leg. C. H. Dickenson. Text Page 29
32. *S. coronis semiramis*, ♀, underside, El Cajon, San Diego Co, July 4, 1956, leg. O. Shields. Text Page 30
33. *Euptoieta claudia*, ♂, New York Mts, San Bernardino Co, September 6, 1936, leg. R. Andrews & L. M. Martin. Text Page 28
34. *Speyeria hydaspe viridicornis*, ♂, Greenhorn Mts, Kern Co, July 3, 1932, leg. L. M. Martin. Text Page 30
35. *S. hydaspe viridicornis*, ♀, underside, Greenhorn Mts, Kern Co, July 2, 1939, leg. J. Comstock. Text Page 30
36. *S. coronis hennei*, ♀, Lebec, Kern Co, June 20, 1938, leg. J. Comstock. Text Page 30





EXPLANATION OF PLATE 4

1. *Speyeria coronis hennei*, ♂, underside, Ridge Route, Los Angeles Co, July, 1932, leg. J. Comstock. Text Page 30
2. *S. callippe comstocki*, ♂, Griffith Park, Los Angeles Co, June 2, 1920, leg. J. Comstock. Text Page 30
3. *S. callippe comstocki*, ♀, underside, Griffith Park, Los Angeles Co, June 5, 1930, leg. C. Henne. Text Page 30
4. *S. callippe macaria*, ♂, underside, 1 mile S. of Lebec, June 8, 1957, leg. O. E. Sette. Text Page 31
5. *S. callippe macaria*, ♀, Mt Pinos, Kern Co, June 23, 1962, leg. J. Emmel. Text Page 31
6. *S. callippe macaria* f. "laurina", ♂, underside, Ridge Route, Los Angeles Co, July, 1932, leg. J. Comstock. Text Page 31
7. *S. egleis tehachapina*, ♀, Tehachapi Mts. Kern Co, July 23, 1932, leg. L. M. Martin. Text Page 31
8. *S. egleis tehachapina*, ♂, underside, Tehachapi Mts, Kern Co, July 23, 1932, leg. L. M. Martin. Text Page 31
9. *Boloria epithore sierra*, ♂, Tiger Flat Campground road, Greenhorn Mts, Kern Co, June 24, 1961, leg. R. E. Stanford (Allyn Museum). Text Page 32
10. *B. epithore sierra*, ♂, underside, Tiger Flat Campground road, Greenhorn Mts, Kern Co, June 24, 1961, leg. R. E. Stanford (Allyn Museum). Text Page 32
11. *Euphydryas chalcedona chalcedona*, ♂, 5 miles north of Beverly Hills, Santa Monica Mts, Los Angeles Co, emerged May 7, 1957, leg. N. McFarland. Text Page 32
12. *E. chalcedona chalcedona*, ♀, 5 miles north of Beverly Hills, Santa Monica Mts, Los Angeles Co, emerged May 13, 1957, leg. N. McFarland. Text Page 32
13. *E. chalcedona quino*, ♂, 3 miles W. of Jacumba, San Diego Co, March 20, 1960, leg. O. Shields. Text Page 33
14. *E. chalcedona kingstonensis*, ♂, near Mitchell Caverns State Park, Providence Mts, San Bernardino Co, April 13, 1963, leg. O. Shields. Text Page 33
15. *E. chalcedona kingstonensis*, ♀, near Mitchell Caverns State Park, Providence Mts, San Bernardino Co, April 13, 1963, leg. O. Shields. Text Page 33
16. *E. chalcedona corralensis*, ♂, Rock Corral, northeast edge of San Bernardino Mts, March 18, 1936, leg. C. Dammers, paratype. Text Page 33
17. *E. chalcedona corralensis*, ♀, Rock Corral, northeast edge of San Bernardino Mts, April 3, 1936, leg. C. Dammers, paratype. Text Page 33
18. *E. chalcedona quino*, ♀, 3 miles W. of Jacumba, San Diego Co, March 20, 1960, leg. O. Shields. Text Page 33
19. *E. editha editha*, ♂, Woolstaff Meadows, Piute Mts, Kern Co, May 27, 1934, leg. W. N. Burdick. Text Page 34
20. *E. editha editha*, ♀, underside, Piute Mts, Kern Co, May 20, 1934. Text Page 34
21. *E. editha augusta*, ♂, Fish Camp, San Bernardino Mts, June 8, 1936, leg. C. Dammers. Text Page 34
22. *E. editha augusta*, ♀, Fish Camp, San Bernardino Mts, June 8, 1936, leg. C. Dammers. Text Page 34
23. *E. editha* near *bayensis*, ♂, Surf, Santa Barbara Co, March 19, 1935, leg. C. W. Kirkwood. Text Page 34
24. *E. editha wrightii*, ♂, Rancho Santa Fe, San Diego Co, February 27, 1933, leg. G. H. & J. L. Sperry. Text Page 34
25. *E. editha wrightii*, ♀, Rancho Santa Fe, San Diego Co, March 22, 1933, leg. C. Henne. Text Page 34
26. *Chlosyne neumoegeni*, ♂, 20 miles southeast of Mojave, Kern Co, April 10, 1955, leg. N. McFarland. Text Page 34
27. *C. neumoegeni*, ♀, 20 miles southeast of Mojave, Kern Co, April 10, 1955, leg. N. McFarland. Text Page 34
28. *Euphydryas editha* near *bayensis*, ♀, Surf, Santa Barbara Co, March 19, 1935, leg. C. W. Kirkwood. Text Page 34
29. *Chlosyne palla*, ♂, Ridge Route, Tejon Range, June 21, 1923, leg. J. Comstock. Text Page 35
30. *C. palla*, ♀, Ridge Route, Tejon Range, June 21, 1923, leg. J. Comstock. Text Page 35
31. *C. palla vallismortis*, ♂, Wildrose Canyon, Panamint Mts, Inyo Co, June 11, 1939, leg. W. Hovanitz. Text Page 35
32. *C. gabbii gabbii*, ♂, Hermosa Beach, Los Angeles Co, March 4, 1939. Text Page 35
33. *C. neumoegeni*, ♂, underside, Black Hawk Canyon, 33 miles east-southeast of Victorville, Calif, April 9, 1955, leg. O. Sette. Text Page 34
34. *C. gabbii gabbii*, ♀, Topanga, Los Angeles Co, April 21, 1956, leg. H. Notman. Text Page 35
35. *C. leanira daviesi*, ♂, Indian Flats, near El Portal, Mariposa Co, May 31, 1958, leg. L. M. Martin. Text Page 36
36. *C. leanira wrightii*, ♂, Mint Canyon road, Los Angeles Co, May 1, 1921, leg. J. Comstock. Text Page 36
37. *C. leanira wrightii*, ♀, underside, Phelan, San Bernardino Co, April 29, 1932. Text Page 36
38. *C. leanira cerrita*, ♀, Mint Canyon, Los Angeles Co, May 8, 1925, leg. J. Comstock. Text Page 36
39. *C. leanira* near *alma*, ♀, Argus Mts, Inyo Co, May 13, 1935. Text Page 36
40. *C. leanira* near *alma*, ♂, Argus Mts, Inyo Co, May 13, 1935. Text Page 36
41. *C. lacinia crocale* f. "rufescens", ♂, Indio, Riverside Co, May 10, 1932, leg. C. Dammers. Text Page 36
42. *C. lacinia crocale* f. "nigrescens", ♀, Blythe, Riverside Co, March 27, 1935, leg. C. Dammers. Text Page 36
43. *C. lacinia crocale*, ♂, Brawley, Imperial Co, May 4, 1932, leg. C. Dammers. Text Page 36
44. *C. californica*, ♀, Morongo, San Bernardino Co, May 23, 1932, leg. C. Dammers. Text Page 37
45. *C. californica*, ♂, underside, Palm Springs, Riverside Co, October 18, 1921, leg. J. Gunder. Text Page 37
46. *Microtia dymas imperialis*, ♂, Palm Springs, Riverside Co, March 7, 1923, leg. K. Coolidge. Text Page 38
47. *M. dymas imperialis*, ♀, Palm Springs, Riverside Co, June 2, 1928, leg. K. Coolidge. Text Page 38



EXPLANATION OF PLATE 5

1. *Phyciodes campestris campestris*, ♂, San Bernardino, emerged November 17, 1930, leg. C. Dammers. Text Page 39
2. *P. campestris campestris*, ♀, Santa Fe Depot, San Bernardino, May 17, 1929, leg. C. Dammers. Text Page 39
3. *P. tharos* (California segregate), ♂, Del Rio Club, Brawley, Imperial Co, October 9, 1935, leg. C. Henne (Henne collection). Text Page 39
4. *P. tharos* (California segregate), ♀, Del Rio Club, Brawley, Imperial Co, October 9, 1935, leg. C. Henne (Henne collection). Text Page 39
5. *P. phaon*, ♂, El Cajon, San Diego Co, April 2, 1961, leg. O. Shields. Text Page 38
6. *P. phaon*, ♀, El Cajon, San Diego Co, February 22, 1958, leg. O. Shields. Text Page 38
7. *P. mylitta mylitta*, ♂, Forest Home, San Bernardino Mts, June 4, 1940, leg. C. Dammers. Text Page 39
8. *P. mylitta mylitta*, ♀, San Gabriel Canyon, Los Angeles Co, May 12, 1962, leg. J. Emmel. Text Page 39
9. *Polygonia zephyrus*, ♂, Donner Summit, Placer Co, August 9, 1960, leg. J. Emmel. Text Page 41
10. *P. satyrus satyrus*, ♂, Coldbrook Camp, San Gabriel Canyon, Los Angeles Co, June 2, 1962, leg. J. Emmel. Text Page 40
11. *P. satyrus satyrus*, ♂, underside west side of Mono Lake Mono Co June 27/ 1961 leg. O. Shields. Text Page 40
12. *Nymphalis antiopa antiopa*, ♂, Santa Monica Mts, Los Angeles Co, September 26, 1954, leg. N. McFarland. Text Page 41
13. *Polygonia zephyrus*, ♂, underside, Monache Meadows, Tulare Co, August 3, 1917, leg. J. Comstock. Text Page 41
14. *Nymphalis californica californica*, ♂, Laguna Mts, San Diego Co, June 17, 1960, leg. O. Shields. Text Page 41
15. *N. milberti furcillata*, ♀, Tehachapi Mountain Park, Tehachapi Mts, Kern Co, May 30, 1962, leg. J. Emmel. Text Page 42
16. *Vanessa atalanta rubria*, ♂, Riverside, February 24, 1930, leg. C. Dammers. Text Page 42
17. *V. atalanta rubria* x *Cynthia annabella* = hybrid f. "edwardsi", ♂, Rolling Hills, Palos Verdes Peninsula, Los Angeles Co, ex larva on *Urtica holosericea*, April 1956, emerged May 26, 1956, leg. C. Ingham & C. Henne (Henne collection). Text Page 44
18. *Cynthia annabella*, ♂, Topanga, Los Angeles Co, October 14, 1957, leg. H. Notman. Text Page 43
19. *C. cardui*, ♂, Chino, San Bernardino Co, June 2, 1956, leg. T. M. Blackman. Text Page 43
20. *Limenitis archippus obsoleta*, ♂, Blythe, Riverside Co, emerged November 26, 1932, leg. C. Dammers. Text Page 45
21. *Precis nigrosuffusa*, ♀, 4½ miles southeast of Sonoita on Highway 82, Arizona, October 17, 1956, leg. F. Thorne (Thorne collection). Text Page 45
22. *P. coenia*, ♀, Riverside, Calif., November 15, 1929, leg. C. Dammers. Text Page 45
23. *Cynthia virginiensis*, ♂, San Bernardino, June 10, 1931, leg. C. Dammers. Text Page 44
24. *Limenitis lorquini lorquini*, ♂, Tehachapi, Kern Co, July 1, 1921, leg. J. Comstock. Text Page 45
25. *Adelpha bredowii californica*, ♀, Santa Ana River, 5000', San Bernardino Mts, July 15, 1961, leg. J. Emmel. Text Page 46
26. *Libytheana bachmanii larvata*, ♂, Juniper Hills, near Pearblossom, 3500', Los Angeles Co, October 16, 1970, leg. C. Henne (Henne collection). Text Page 47
27. *Atlides halesus corcorani*, ♀, Palm Springs, Riverside Co, April 20, 1919, leg. J. Comstock. Text Page 51
28. *A. halesus corcorani*, ♂, Riverside, September 16, 1931, leg. C. Dammers. Text Page 51
29. *Apodemia mormo mormo*, ♀, Gold Valley, 4600', Mid Hills, San Bernardino Co, August 31, 1963, leg. O. Shields. Text Page 48
30. *A. mormo virgulti*, ♂, El Cajon, San Diego Co, May 2, 1959, leg. O. Shields. Text Page 48
31. *A. mormo virgulti*, ♂, El Cajon, San Diego Co, May 10, 1959, leg. O. Shields. Text Page 48
32. *A. mormo cythera*, ♀, 1.2 miles north of Mile High, 4800', San Gabriel Mts, Los Angeles Co, September 16, 1968, leg. C. Henne (Henne collection). Text Page 48
33. *A. mormo cythera*, ♂, Bishop Creek, Inyo Co, July 22, 1934, leg. C. N. Rudkin. Text Page 48
34. *A. mormo deserti*, ♂, San Felipe Wash, San Diego Co, Emerged October 24, 1936, leg. J. Comstock. Text Page 49
35. *A. mormo deserti*, ♀, Palm Springs, Riverside Co, March 11, 1933, leg. C. Dammers. Text Page 49
36. *A. mormo* near *dialeuca*, ♂, Sugarloaf Mountain road, near Big Bear Lake, San Bernardino Mts, May 26, 1968, leg. J. Lane. Text Page 49
37. *A. palmerii marginalis*, ♂, Borrego, San Diego Co, April 26, 1946, leg. G. H. & J. L. Sperry. Text Page 49
38. *A. palmerii marginalis*, ♀, Indian Wells, Coachella Valley, September 30, 1921, leg. J. Comstock. Text Page 49
39. *A. palmerii marginalis*, ♀, underside, Indian Wells, Coachella Valley, October 7, 1930, leg. C. Dammers. Text Page 49
40. *Calephelis nemesis dammersi*, ♀, Blythe, Riverside Co, September 29, 1933, leg. C. Henne. Text Page 50
41. *C. nemesis californica*, ♂, Baldwin Hills near Culver City, Los Angeles Co, February 19, 1961, leg. J. Emmel. Text Page 50
42. *C. nemesis californica*, ♀, Baldwin Hills near Culver City, Los Angeles Co, February 19, 1961, leg. J. Emmel. Text Page 50
43. *C. wrighti*, ♂, Riverside, June 29, 1931, leg. C. Dammers. Text Page 51

44. *C. wrighti*, ♀, Palm Springs, Riverside Co, September 20, 1931, leg. C. Dammers. Text Page 51

45. *C. wrighti*, ♂, underside, Whitewater grade, at 1000', Riverside Co, March 26, 1964, leg. N. McFarland. Text Page 51

46. *Habrodais grunus grunus*, ♂, Mt. Wilson, Los Angeles Co, June 25, 1919, leg. J. Comstock. Text Page 51

47. *H. grunus grunus*, ♂, underside, San Gabriel Mts, Los Angeles Co, July 4, 1922, leg. J. Comstock. Text Page 51



EXPLANATION OF PLATE 6

1. *Strymon avalona*, ♂, Catalina Island, Los Angeles Co, August 6, 1925, leg. J. Comstock. Text Page 51
2. *S. avalona*, ♂, underside, Catalina Island, Los Angeles Co, July, 1928, leg. C. Dammers. Text Page 51
3. *S. melinus pudica*, ♂, Anacapa Island, emerged September 11, 1940, leg. C. Henne. Text Page 52
4. *S. melinus pudica*, ♂, underside, El Cajon, San Diego Co, February 25, 1961, leg. O. Shields. Text Page 52
5. *S. columella istapa*, ♂, Bard, Imperial Co, November 25, 1935, leg. C. Dammers. Text Page 53
6. *S. columella istapa*, ♀, Laguna Mts, San Diego Co, May 6, 1962, leg. O. Shields. Text Page 53
7. *S. columella istapa*, ♀, underside, Fertilla, Riverside Co, September 30, 1935, leg. L. M. Martin. Text Page 53
8. *Ministrymon leda*, ♂, San Felipe Wash, San Diego Co, September 11, 1938, leg. J. Comstock. Text Page 54
9. *M. leda*, ♀, San Felipe Wash, San Diego Co, September 11, 1938, leg. J. Comstock. Text Page 54
10. *M. leda*, ♀, underside, San Felipe Wash, San Diego Co, August 16, 1935. Text Page 54
11. *M. ines*, ♂, underside, Vallecito, San Diego Co, November 12, 1945, leg. J. Comstock. Text Page 54
12. *Satyrium californica*, ♂, Mt. Wilson, Los Angeles Co, July 13, 1933. Text Page 54
13. *S. californica*, ♀, Mt. Wilson, Los Angeles Co, July 13, 1933. Text Page 54
14. *S. californica*, ♂, underside, Sheep Canyon, San Bernardino Co, May 29, 1925, leg. V. W. Owen. Text Page 54
15. *S. sylvinus sylvinus*, ♂, Riverside, July 1, 1933, leg. C. Dammers. Text Page 54
16. *S. sylvinus sylvinus*, ♀, Los Angeles River, Los Angeles Co, June 18, 1940, leg. A. H. Forsman. Text Page 54
17. *S. sylvinus sylvinus*, ♂, underside, Riverside, July 1, 1933, leg. C. Dammers. Text Page 54
18. *S. sylvinus dryope*, ♂, 3 miles S. of Palo Alto, Santa Clara Co. June 19, 1960, leg. O. Sette. Text Page 55
19. *S. sylvinus dryope*, ♀, 3 miles S. of Palo Alto, Santa Clara Co, June 19, 1960, leg. O. Sette. Text Page 55
20. *S. sylvinus dryope*, ♀, underside, Rose Valley, Ventura Co, July 30, 1935, leg. C. W. Kirkwood. Text Page 55
21. *S. sylvinus desertorum*, ♂, underside, Tehachapi, Kern Co, July 9, 1918. Text Page 55
22. *S. behrii behrii*, ♂, Doble, San Bernardino Mts, Calif, July 6, 1931, leg. C. Dammers. Text Page 55
23. *S. behrii behrii*, ♀, underside, Sheep Creek, San Gabriel Mts, San Bernardino Co, June 27, 1928, leg. C. Dammers. Text Page 55
24. *S. auretteorum spadix*, ♂, Cajon Pass, San Bernardino Co, June 23, 1933, leg. J. Comstock. Text Page 55
25. *S. auretteorum spadix*, ♀, Cajon Pass, San Bernardino Co, June 23, 1933, leg. J. Comstock. Text Page 55
26. *S. auretteorum spadix*, ♂, underside, Cajon Pass, San Bernardino Co, June 23, 1933, leg. J. Comstock. Text Page 55
27. *S. tetra*, ♂, Griffith Park, Los Angeles Co, July 3, 1940. Text Page 56
28. *S. tetra*, ♀, Bouquet Canyon, Los Angeles Co, emerged July 3, 1937, leg. J. Comstock. Text Page 56
29. *S. tetra*, ♀, underside, Bouquet Canyon, Los Angeles Co, emerged June 21, 1937, leg. J. Comstock. Text Page 56
30. *S. saepium saepium*, ♂, Chuchupate Campground, Ventura Co, July 1, 1962, leg. J. Emmel. Text Page 56
31. *S. saepium saepium*, ♀, Bouquet Canyon, Los Angeles Co, emerged May 28, 1937, leg. J. Comstock. Text Page 56
32. *S. saepium saepium*, ♂, underside, Forest Home, San Bernardino Mts, July 8, 1928, leg. C. Dammers. Text Page 56
33. *Chlorostymon simaethis sarita*, ♀, underside, Santa Ana Refuge, Hidalgo Co, Texas, October 5, 1968, leg. M. Richard (Thorne collection). Text Page 53
34. *Mitoura spinetorum*, ♂, Boiling Springs, Laguna Mts, San Diego Co, May 9, 1965, leg. O. Shields. Text Page 57
35. *M. spinetorum*, ♀, near Horse Haven, near Laguna Lakes, Laguna Mts., San Diego Co, May 25, 1958, leg. O. Shields. Text Page 57
36. *M. spinetorum*, ♂, underside, Boiling Springs, Laguna Mts, San Diego Co, July 22, 1956, leg. O. Shields. Text Page 57
37. *M. nelsoni nelsoni*, ♂, Cedarpines Park, San Bernardino Mts, June 14, 1930, leg. L. M. Martin. Text Page 57
38. *M. nelsoni nelsoni*, ♀, Blue Jay, near Lake Arrowhead, San Bernardino Mts, June 30, 1955, leg. N. McFarland. Text Page 57
39. *M. nelsoni nelsoni*, ♀, underside, north of Cuyamaca Lake, 5 miles south-southeast of Julian, San Diego Co, June 17, 1961, leg. O. Shields. Text Page 57
40. *M. siva siva*, ♂, Keystone Canyon, New York Mts, San Bernardino Co, ex female June 4, 1968, emerged April 17, 1969, leg. C. Henne (Henne collection). Text Page 58
41. *M. siva siva*, ♀, Bonanza King Canyon, Providence Mts, San Bernardino Co, April 9, 1966, leg. O. Shields. Text Page 58
42. *M. siva siva*, ♂, underside, Keystone Canyon, New York Mts, San Bernardino Co, ex female June 4, 1968, emerged June 4, 1969, leg. C. Henne (Henne collection). Text Page 58
43. *M. siva juniperaria*, ♂, Littlerock, Los Angeles Co, April 9, 1960, leg. O. Shields. Text Page 58
44. *M. siva juniperaria*, ♀, Jct. of Hwy. 66 & Hwy. 395, 4.5 road miles northeast of Cajon Pass, San Bernardino Co, April 3, 1966, leg. O. Shields. Text Page 58
45. *M. siva juniperaria*, ♀, underside, Mint Canyon, Los Angeles Co, April 14, 1923, leg. J. Comstock. Text Page 58
46. *M. siva mansfieldi*, ♂, underside, 7 miles northwest of Simmler, San Luis Obispo Co, April 8, 1960, leg. O. Sette. Text Page 59

47. *M. loki*, ♂, Gavilan Hills, Riverside Co, emerged May 29, 1940, leg. C. Henne. Text Page 59
48. *M. loki*, ♀, Gavilan Hills, Riverside Co, emerged January 6, 1947, leg. J. Comstock & L. M. Martin. Text Page 59
49. *M. loki*, ♀, underside, 5 miles east of Jacumba, San Diego Co, March 19, 1961, leg. O. Shields. Text Page 59
50. *Incisalia eryphon*, ♂, Kaiser Crest, Fresno Co, June 21, 1961, leg. J. Emmel. Text Page 59
51. *I. eryphon*, ♀, Hunters Flats, Inyo Co, June 11, 1939. Text Page 59
52. *I. eryphon*, ♂, underside, Huntington Lake, Fresno Co, June 21, 1961, leg. J. Emmel. Text Page 59
53. *I. augustinus iroides*, ♂, Topanga, Los Angeles Co, June 6, 1968, leg. H. Notman. Text Page 60
54. *I. augustinus iroides*, ♀, Topanga, Los Angeles Co, June 18, 1955, leg. H. Notman. Text Page 60
55. *I. augustinus iroides*, ♀, underside, Perris, Riverside Co, March 17, 1953. Text Page 60
56. *I. augustinus* near *annetteae*, ♂, underside, Providence Mts, San Bernardino Co, March 21, 1934, leg. C. Henne. Text Page 60
57. *I. fotis fotis*, ♀, Providence Mts, San Bernardino Co, March 21, 1934, leg. C. Henne. Text Page 60
58. *I. fotis fotis*, ♀, underside, Providence Mts, San Bernardino Co, March 21, 1934, leg. C. Henne. Text Page 60
59. *Callophrys dumetorum dumetorum*, ♂, Santa Monica Mts, Los Angeles Co, March 27, 1955, leg. N. McFarland. Text Page 61
60. *C. dumetorum dumetorum*, ♀, Los Angeles, March, 1920, leg. J. Comstock. Text Page 61
61. *C. dumetorum dumetorum*, ♂, underside, Perris, Riverside Co., March 7, 1953. Text Page 61
62. *C. comstocki*, ♀, canyon 1.4 air miles southeast of Horse Thief Springs, 4700', Kingston Range, San Bernardino Co, ex female March 29, 1969, emerged August, 1970, leg. J. Emmel & O. Shields. Text Page 61
63. *C. comstocki*, ♂, underside, near Mitchell Caverns State Park, Providence Mts, San Bernardino Co, March 25, 1970, leg. J. Emmel & O. Shields. Text Page 61
64. *Lycaena arota nubila*, ♂, Griffith Park, Los Angeles Co, July 2, 1922, leg. J. Comstock, paratype. Text Page 61
65. *L. arota arota*, ♀, Frazier Park, Kern Co, July 1, 1962, leg. J. Emmel. Text Page 61
66. *L. arota arota*, ♀, underside, Frazier Park, Kern Co, July 1, 1962, leg. J. Emmel. Text Page 61
67. *L. arota nubila*, ♀, Griffith Park, Los Angeles Co, July 2, 1922, leg. J. Comstock, paratype. Text Page 61
68. *L. gorgon*, ♂, El Cielo Drive, Santa Barbara Co, June 19, 1948, leg. C. Kirkwood. Text Page 63





EXPLANATION OF PLATE 7

1. *Lycaena gorgon*, ♀, Dripping Springs, Riverside Co, June 13, 1953, leg. R. H. Reid. Text Page 63
2. *L. gorgon*, ♂, underside, El Cielo Drive, Santa Barbara Co, June 19, 1948, leg. C. Kirkwood. Text Page 63
3. *L. xanthoides xanthoides*, ♂, Bouquet Canyon, Los Angeles Co, May 1, 1960, leg. J. Emmel. Text Page 63
4. *L. xanthoides xanthoides*, ♀, Laguna Mts, San Diego Co, June 27, 1960, leg. O. Shields. Text Page 63
5. *L. xanthoides xanthoides*, ♂, underside, Bouquet Canyon, Los Angeles Co, May 1, 1960, leg. J. Emmel. Text Page 63
6. *L. hermes*, ♂, El Cajon, San Diego Co, May 31, 1958, leg. O. Shields. Text Page 62
7. *L. hermes*, ♀, San Diego, June 13, 1924, leg. J. Comstock. Text Page 62
8. *L. hermes*, ♂, underside, San Diego, June 1, 1932, leg. C. Dammers. Text Page 62
9. *L. helloides*, ♂, Pasadena, August 4, 1903. Text Page 64
10. *L. helloides*, ♀, Riverside, August 31, 1929, leg. C. Dammers. Text Page 64
11. *L. helloides*, ♀, underside, Prado, near Corona, Riverside Co, October 28, 1933, leg. C. Dammers. Text Page 64
12. *L. heteronea clara*, ♂, near Lebec, Kern Co, July 1, 1927, leg. J. Comstock. Text Page 64
13. *L. heteronea clara*, ♀, near Lebec, Kern Co, July 1, 1927, leg. J. Comstock. Text Page 64
14. *L. heteronea clara*, ♀, underside, Tehachapi Mts, 6000', Kern Co, July 9, 1918, leg. J. Comstock. Text Page 64
15. *Brephidium exilis*, ♀, Riverside, emerged November 27, 1936, leg. C. Dammers. Text Page 65
16. *B. exilis*, ♂, underside, Los Angeles, May 11, 1959, leg. J. Emmel. Text Page 65
17. *Leptotes marina*, ♂, Topanga, Los Angeles Co, June 25, 1958, leg. H. Notman. Text Page 64
18. *L. marina*, ♀, Topanga, Los Angeles Co, July 3, 1959, leg. H. Notman. Text Page 64
19. *L. marina*, ♀, underside, Los Angeles, September 12, 1960, leg. J. Emmel. Text Page 64
20. *Hemiargus ceraunus gyas*, ♂, El Cajon, San Diego Co, October 12, 1958, leg. O. Shields. Text Page 65
21. *H. ceraunus gyas*, ♀, El Cajon, San Diego Co, September 20, 1958, leg. O. Shields. Text Page 65
22. *H. ceraunus gyas*, ♂, underside, Perris, Riverside Co, August 9, 1952. Text Page 65
23. *H. isola alce*, ♂, Laguna Mts, San Diego Co, May 25, 1958, leg. O. Shields. Text Page 66
24. *H. isola alce*, ♀, Palomar Mts, San Diego Co, May 17, 1959, leg. O. Shields. Text Page 66
25. *H. isola alce*, ♂, underside, Pinyon Flat, San Jacinto Mts, Riverside Co, July 3, 1932, leg. C. Dammers. Text Page 66
26. *Everes amyntula*, ♂, Laguna Mts, San Diego Co, May 21, 1961, leg. O. Shields. Text Page 66
27. *E. amyntula*, ♀, El Cajon, San Diego Co, May 31, 1958, leg. O. Shields. Text Page 66
28. *E. amyntula*, ♂, underside, Swartout Valley, San Gabriel Mts, May 27, 1925, leg. J. Comstock. Text Page 66
29. *Plebejus saepiolus hilda*, ♂, near Idyllwild, San Jacinto Mts, June 10, 1925, leg. J. Comstock. Text Page 66
30. *P. saepiolus hilda*, ♀, near Idyllwild, San Jacinto Mts, June 10, 1925, leg. J. Comstock. Text Page 66
31. *P. saepiolus hilda*, ♀, underside, near Idyllwild, San Jacinto Mts, June 10, 1925, leg. J. Comstock. Text Page 66
32. *P. icarioides evius*, ♂, Tehachapi, Kern Co, July 9, 1918, leg. J. Comstock. Text Page 67
33. *P. icarioides evius*, ♀, Tehachapi Mountain Park, Tehachapi Mts, Kern Co, May 30, 1960, leg. J. Emmel. Text Page 67
34. *P. icarioides evius*, ♂, underside, Tehachapi Mountain Park, Tehachapi Mts, Kern Co, May 30, 1960, leg. J. Emmel. Text Page 67
35. *P. icarioides moroensis*, ♂, Halcyon, San Luis Obispo Co, May 9, 1937, leg. L. M. Martin. Text Page 67
36. *P. icarioides moroensis*, ♀, Halcyon, San Luis Obispo Co, April 25, 1935, leg. V. L. Clemence. Text Page 67
37. *P. icarioides moroensis*, ♂, Halcyon, San Luis Obispo Co, April 17, 1935, leg. V. L. Clemence. Text Page 67
38. *P. icarioides* (Argus Mts population), ♂, Argus Mts, Inyo Co, May 9, 1936, leg. L. M. Martin. Text Page 67
39. *P. icarioides* (Argus Mts population), ♀, Argus Mts, Inyo Co, May 6, 1934, leg. M. L. Walton. Text Page 67
40. *P. icarioides* (Argus Mts population), ♂, underside, Argus Mts, Inyo Co, May 17, 1936, leg. L. M. Martin. Text Page 67
41. *P. acmon acmon*, ♂, El Cajon, San Diego Co, February 28, 1959, leg. O. Shields. Text Page 67
42. *P. acmon acmon*, ♀, Topanga, Los Angeles Co, June 30, 1956, leg. H. Notman. Text Page 67
43. *P. acmon acmon*, ♀, underside, Riverside, April 29, 1928, leg. C. Dammers. Text Page 67
44. *P. acmon texanus*, ♂, Portal, Arizona, June 5, 1958. Text Page 67
45. *P. acmon texanus*, ♀, Huachuca Mts, S. Arizona, June 2, 1935, leg. J. Comstock. Text Page 67
46. *P. acmon texanus*, ♀, underside, Santa Rita Mts, 5000', Arizona, November 13, 1952, leg. O. Sette. Text Page 67
47. *P. lupini monticola*, ♂, Ridge Route, Los Angeles Co, July 15, 1920, leg. J. Comstock. Text Page 67
48. *P. lupini monticola*, ♀, Bouquet Canyon, Los Angeles Co, June 3, 1923, leg. J. Comstock. Text Page 67
49. *P. emigdionis*, ♂, Victorville, San Bernardino Co, April 13, 1932, leg. J. L. Sperry. Text Page 69

50. *P. emigdionis*, ♀, Bouquet Canyon, Los Angeles Co, May 1, 1960, leg. J. Emmel. Text Page 69
51. *P. emigdionis*, ♂, underside, Victorville, San Bernardino Co, May 17, 1929, leg. C. Dammers. Text Page 69
52. *P. neurona*, ♂, 1.1 road miles NW of Lake-of-the-Woods, 5400', Kern Co, May 30, 1960, leg. J. Emmel. Text Page 68
53. *P. neurona*, ♀, 1.1 road miles NW of Lake-of-the-Woods, 5400', Kern Co, May 30, 1960, leg. J. Emmel. Text Page 68
54. *P. neurona*, ♀, underside, Mt. Wilson, Los Angeles Co, June 20, 1918, leg. J. Comstock. Text Page 68
55. *P. melissa inyoensis*, ♂, underside, Laguna Mts, San Diego Co, May 25, 1958, leg. O. Shields. Text Page 69
56. *P. melissa inyoensis*, ♂, Laguna Mts, San Diego Co, May 25, 1958, leg. O. Shields. Text Page 69
57. *P. melissa inyoensis*, ♀, 5 miles east of Pine Valley, Laguna Mts, San Diego Co, May 21, 1961, leg. O. Shields. Text Page 69
58. *P. melissa inyoensis*, ♀, Tehachapi, Kern Co, Calif, July 15, 1918, leg. K. Coolidge. Text Page 69
59. *Philotes battoides bernardino*, ♂, Etiwanda, San Bernardino Co, June 7, 1935, leg. C. Henne (Henne collection). Text Page 70
60. *P. battoides bernardino*, ♀, Juniper Hills, 2 miles south of Pearblossom, Los Angeles Co, June 1, 1967, leg. C. Henne (Henne collection). Text Page 70
61. *P. battoides bernardino*, ♂, underside, Juniper Hills, 3700', Los Angeles Co, May 13, 1964, leg. C. Henne (Henne collection). Text Page 70



EXPLANATION OF PLATE 8

1. *Philotes battoides* (Los Angeles County coastal segregate), ♂, El Segundo Dunes, Los Angeles Co, July 22, 1939, leg. C. Henne (Henne collection). Text Page 70
2. *P. battoides* (Los Angeles County coastal segregate), ♀, El Segundo Dunes, Los Angeles Co, July 25, 1970, leg. C. Henne (Henne collection). Text Page 70
3. *P. battoides* (Los Angeles County coastal segregate), ♀, underside, El Segundo Dunes, Los Angeles Co, July 24, 1970, leg. C. Henne (Henne collection). Text Page 70
4. *P. battoides martini*, ♂, Indian Rock, near Sunflower Spring, Old Woman Mts, San Bernardino Co, May 8, 1965, leg. C. Henne (Henne collection). Text Page 70
5. *P. battoides martini*, ♀, buttes near Rand Mts, southwest of Randsburg, Kern Co, May 4, 1936, leg. C. Henne (Henne collection). Text Page 70
6. *P. battoides martini*, ♂, underside, Indian Rock, near Sunflower Spring, Old Woman Mts, San Bernardino Co, May 8, 1965, leg. C. Henne (Henne collection). Text Page 70
7. *P. battoides* (eastern Mojave Desert segregate), ♀, underside, Bonanza King Mine Canyon, Providence Mts, San Bernardino Co, September 17, 1970, leg. O. Shields. Text Page 71
8. *P. battoides* (Tehachapi segregate), ♂, Tehachapi, Kern Co, July 22, 1918, leg. J. Comstock. Text Page 71
9. *P. battoides* (Tehachapi segregate), ♀, Tehachapi, Kern Co, July 22, 1918, leg. J. Comstock. Text Page 71
10. *P. enoptes dammersi*, ♂, Whitewater Canyon, Coachella Valley, Riverside Co, ex larva October 5, 1967, emerged August 30, 1969, leg. C. Henne (Henne collection). Text Page 71
11. *P. enoptes dammersi*, ♀, Whitewater Canyon, Coachella Valley, Riverside Co, September 29, 1967, leg. C. Henne (Henne collection). Text Page 71
12. *P. enoptes dammersi*, ♀, underside, Whitewater Canyon, Coachella Valley, Riverside Co, September 29, 1967, leg. C. Henne (Henne collection). Text Page 71
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22. *P. rita elvirae*, ♂, underside, Juniper Hills, 3500', near Pearblossom, Los Angeles Co, July 17, 1970, leg. C. Henne (Henne collection). Text Page 72
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34. *H. harpalus leussleri*, ♀, Laguna Mts, San Diego Co, May 30, 1959, leg. O. Shields. Text Page 83
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38. *H. harpalus* (Tehachapi blend zone population), ♀, underside, Tehachapi, Kern Co, August 20, 1919, leg. J. Comstock. Text Page 83
39. *H. harpalus yosemite*, ♂, Huntington Lake, Fresno Co, August 22, 1930, leg. L. M. Martin. Text Page 83
40. *H. harpalus yosemite*, ♀, 10 miles east of Downieville, Sierra Co, June 30, 1959. Text Page 83
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43. *H. lindseyi*, ♀, Mint Canyon, Los Angeles Co, May 30, 1960, leg. J. Emmel. Text Page 83
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46. *H. columbia*, ♂, underside, Mt. Kentwood, near Julian, San Diego Co, October 5, 1958. Text Page 84
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48. *H. pahaska martini*, ♀, 5.4 miles southeast of Ivanpah, New York Mts, San Bernardino Co, September 12, 1955, leg. J. M. & S. N. Burns, paratype. Text Page 84
49. *H. pahaska martini*, ♂, underside, near mouth of Sawmill Canyon, east side of Sheep Range, 6000', Clark Co, Nevada, July 2, 1969, leg. J. Emmel & O. Shields. Text Page 84
50. *H. juba*, ♂, 1 mile south of Julian, San Diego Co, October 5, 1958, leg. O. Shields. Text Page 84
51. *H. juba*, ♀, 1 mile south of Julian, San Diego Co, October 5, 1958, leg. O. Shields. Text Page 84
52. *H. juba*, ♀, underside, Mt. Kentwood, near Julian, San Diego Co, October 1, 1958. Text Page 84





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1. *Pseudocopaodes eunus*, ♂, 1 mile west of Scissors Crossing, San Diego Co, September 9, 1959, leg. O. Shields. Text Page 84
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7. *H. phyleus*, ♀, Baldwin Hills, Los Angeles Co, July 30, 1943, leg. L. Martin. Text Page 85
8. *Copaodes aurantiaca*, ♂, Riverside, September 27, 1928, leg. C. Dammers. Text Page 85
9. *C. aurantiaca*, ♀, El Cajon, San Diego Co, March 12, 1961, leg. O. Shields. Text Page 85
10. *C. aurantiaca*, ♀, underside, El Cajon, San Diego Co, March 18, 1961, leg. O. Shields. Text Page 85
11. *Nastra julia*, ♂, Pharr, Hidalgo Co, Texas, October 27, 1946, leg. H. A. Freeman, topotype. Text Page 86
12. *Pholisora catullus*, ♀, Gavilan Hills, Riverside Co, May 20, 1932, leg. J. Comstock. Text Page 86
13. *P. catullus*, ♂, underside, San Fernando, Los Angeles Co, April 17, 1920, leg. J. Comstock. Text Page 86
14. *P. libya libya*, ♂, Indian Wells, Riverside Co, September 30, 1921, leg. J. Comstock. Text Page 86
15. *P. libya libya*, ♀, Indian Wells, Riverside Co, September 30, 1921, leg. J. Comstock. Text Page 86
16. *P. libya libya*, ♀, underside, Indian Wells, Riverside Co, October 7, 1930, leg. C. Dammers. Text Page 86
17. *P. libya lena*, ♂, Surprise Canyon, Panamint Mts, Inyo Co, August 28, 1965, leg. J. Emmel & O. Shields. Text Page 86
18. *P. libya lena*, ♂, underside, Surprise Canyon, Panamint Mts, Inyo Co, August 28, 1965, leg. J. Emmel & O. Shields. Text Page 86
19. *P. libya* (San Joaquin Valley subspecies), ♂, McKittrick, Kern Co, May 11, 1954, leg. Truxal & Martin. Text Page 86
20. *P. libya* (San Joaquin Valley subspecies), ♀, McKittrick, Kern Co, Calif., May 11, 1954, leg. Truxal & Martin. Text Page 86
21. *P. libya* (San Joaquin Valley subspecies), ♂, underside, McKittrick, Kern Co, May 11, 1954, leg. Truxal & Martin. Text Page 86
22. *P. alpheus oricus*, ♂, Argus Mts, Inyo Co, May 17, 1936, leg. L. Martin. Text Page 86
23. *P. alpheus oricus*, ♀, Argus Mts, Inyo Co, May 17, 1936, leg. L. Martin. Text Page 86
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26. *P. graciellae*, ♂, near Calexico, Imperial Co, May 5, 1934, leg. L. Martin. Text Page 87
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29. *H. ericetorum*, ♀, Topanga, Los Angeles Co, August 6, 1956, leg. H. Notman. Text Page 87
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39. *E. pacuvius callidus*, ♂, near Idyllwild, San Jacinto Mts, Riverside Co, May 30, 1924, leg. J. Comstock. Text Page 91
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